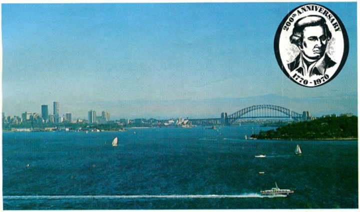
amateur radio

Vol. 37, No. 8
AUGUST, 1969
Registered at G.P.O., Melbourne, for transmission by post as a periodical
PRICE 30 CENTS

AX2WI

Skyline of Sydney, Australia's largest city

CAPTAIN COOK
BI-CENTENARY
CELEBRATIONS
200th anniversary of the discovery and exploration of the east coast of Australia

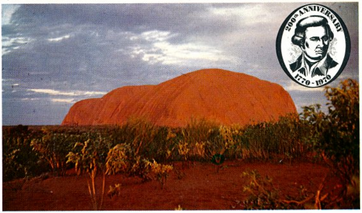


SPECIAL PREFIX FOR AUSTRALIAN AMATEURS FOR 1970 ANNOUNCED

AX3WIA

Ayers Rock, Central Australia

CAPTAIN COOK
BI-CENTENARY
CELEBRATIONS
200th anniversary of the discovery and exploration of the east coast of Australia



COOK BI-CENTENARY INTERNATIONAL AWARD DETAILS ANNOUNCED

NEW VALVES

1B3GT (DY30)	$1.45	6DT6	$1.40
1C7	50c	6DX8	$1.65
1D4	75c	6EA8	$1.55
1F5	$1.00	6ES6	$1.80
1H5	75c	6ES8	$1.80
1K5	50c	6F6G	$1.25
1K7	50c	6G8G	$2.50
1L4	50c, or 5 for $2	6GV8	$1.70
1L5	$1.00	6GW8	$1.70
1LN5	50c	6H6GT	20c, or 12 for $2
1M5	50c	6HG5	$1.50
1P5	50c	6HS8	$1.50
1Q5	50c	6J5GT	$1.00
1R5	$1.80	6J6	75c, or 3 for $2
1S2 (DL86)	$1.45	6J7G	50c, or 5 for $2
1S4	$1.00	6J8G	$3.00
1S5	$1.70	6K6	$1.00
1T4	$1.00	6K7	50c
1X2 A/B	$1.90	6K8GT	$1.25
2D21	$1.20	6K8 Metal	$2.00
3S4	$1.00	6KV8	$1.75
3V4	$1.70	6L6G	$2.90
5AR4, GZ34	$2.45	6L7	50c
5AS4	$1.30	6M5	$1.35
5R4GY	$2.00	6N3	$1.20
5T4	$1.75	6N7	30c, or 10 for $2
5U4GB	$1.30	6N8	$1.40
5V4 (GZ32)	$1.50	6Q7G	$2.50
5Y3GT	$1.20	6R3	$1.55
5Z3	$1.50	6S2	$1.85
6A8G	$2.00	6SA7GT	$2.20
6AB7	$1.00	6SC7	75c
6AC7	50c, or 5 for $2	6SF5	75c
6AD8	$1.35	6SF7	75c
6AE8 (X79)	$3.50	6SH7	50c, or 5 for $2
6AG5	20c, or 12 for $2	6SJ7	75c, or 3 for $2
6AG7	$1.25	6SL7GT	$1.25
6AJ5	75c	6SN7GT	$1.00
6AK5 (EF95)	$2.55	6SQ7GT	$2.10
6AL3	$1.55	6SS7	75c
6AL5	75c	6U4GT	$2.00
6AM5	75c, or 3 for $2	6U7G	75c, or 3 for $2
6AM6	75c, or 3 for $2	6U8/A	$1.55
6AN7/A	$1.55	6V4	$1.05
6AQ5	$1.30	6V6GT	$1.75
6AR7GT	$1.80	6X2	$1.95
6AU4GT/A	$1.50	6X4	$1.00
6AU6	$1.30	6X5GT	$1.50
6AV6	$1.20	6Y9	$1.90
6AX4	$1.50	7A8	35c, or 8 for $2
6B6	$2.00	7C5	50c
6B8	$3.00	7E6	50c, or 5 for $2
6BA6	$1.40	7H7	75c
6BE6	$1.40	7W7	50c, or 5 for $2
6BH5	$1.35	9A8	$1.90
6BK8 (EF86)	$2.00	9U8	$1.75
6BL8	$1.50	12A6	50c, or 5 for $2
6BM8	$1.60	12AH7	50c
6BQ5 (EL84)	$1.50	12AT7	50c, or 5 for 2S
6BQ6GTB/6CU6	$2.50	12AU6	$1.50
6BQ7A	$1.50	12AU7	$1.45
6BV7	$1.35	12AV6	75c
6BX6	$1.35	12AX7 (ECL83)	$1.60
6BY7	$1.95	12BE6	75c
6C4	50c, or 5 for $2	12BY7/A	$1.75
6C8	$1.00	12C8	50c
6CA4	$1.10	12J5	50c
6CA7/EL34	$3.00	12SA7GT	$1.00
6CB6	$1.40	12SC7	50c
6CD6G/A	$4.50	12SH7	50c
6CG7	$1.50	12SK7	50c
6CH6	$2.40	12SN7GT	$1.00
6CK5	$2.00	12SR7	50c, or 5 for $2
6CK6	$1.40	16A8	$2.00
6CM5	$2.20	35L6	$1.00
6CQ6	$2.20	19	50c
6CQ8	$1.40	30	50c
6CS6	$1.30	42	$2.50
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6DC6	$2.40	58	50c
6DC8	$1.90	80	$1.50
6DQ5	$4.75	100TH	$3.00
6DQ6A	$2.20	807	$1.25
6DQ6B	$2.65	808	$1.00
6DS3	$1.80		

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Four-band receiver covering 550 Kc. to 30 Mc. continuous, and electrical bandspread on 10, 15, 20, 40 and 80 metres. 8 valves plus 7 diode circuit. 4/8 ohm output and phone jack. SSB-CW, ANL, variable BFO, S meter, sep. bandspread dial, I.F. 455 kc., audio output 1.5w., variable RF and AF gain controls, 115/250v. AC mains. Beautifully designed. Size: 7 x 15 x 10 in. With instruction manual and service data.

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Speaker to suit, type SP5D, $15 inc. tax.

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To suit Japanese Walkie-Talkies and Transceivers. P.M.G. approved. Freq. 27.240 Mc. (Tx), 26.785 Mc. (Rx).

HC6/U Subminiature, 1/2 in. pin spacing, 27.240 or 26.785 Mc. **$3.50 each** or **$6.50 a pair.**

HC18/U Miniature 1/4 in. pin spacing, 27.240 or 26.785 Mc. **$3.50 each** or **$6.50 a pair.**

(HC18/U also available with flying leads)

Other Crystals available include 27.145 and 27.195 Mc.

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Well known make, sealed boxes, bargain priced, fully guaranteed

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3¼ inch Reels
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5 inch Reels
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5¾ inch Reels
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1200 ft. Acetate $3.40
1200 ft. Mylar $3.75
1800 ft. Mylar $4.75

7 inch Reels
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1200 ft. Mylar $3.75
1800 ft. Acetate $4.50
1800 ft. Mylar $5.00
2400 ft. Mylar $6.25
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954	50c, or 5 for $2	KT66	$4.75
955	50c	KT88	$5.30
956	50c	RL18	75c, or 3 for $2
958A	50c, or 5 for $2	UL41	$1.00
2051	50c	VR150 (volt reg.)	$1.25
5636	75c	2D21	$1.20
5763	$2.55	2E26	$4.60
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6146B	$6.25	75C1 (volt reg.)	$2.25
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BA50	10c, or 12 for $1	150C4/OA2 reg.	$1.65
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EL34 (6CA7)	$3.00	QV04/7	$1.50, 3 $3.75

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12 and 6 volt. Suit Burglar Alarms, Boats, Fire Brigades, etc. Complete with mounting bracket.

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Type F597: 0-50 uA., 2¾ in. round, mounting hole 2-1/16 in. Price $3.75.

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Type F497: 1-0-1 mA., blank scale, 2¼ in. square, mounting hole 2¾ in. Price $3.00.

Type F498: 1-0-1 mA., blank scale, 3 in. square, mounting hole 2¾ in. Price $3.75.

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Type F555: 10 mA., blank scale, 2¼ in. square, mounting hole 1¾ in. Price $3.00.

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Five bands, a.m., c.w., s.s.b., Amateur and Short Wave, 150 Kc. to 400 Kc. and 550 Kc. to 30 Mc. FET front end. Two mechanical filters. Huge dial. Product detector. Crystal calibrator. Variable BFO. Noise Limiter. S Meter. 24 in. bandspread. 230v. a.c./12v. d.c., neg. earth operation. RF gain control. Size: 15 x 9¾ x 8¼ inches. Weight 18 lb. S.A.E. for full details.

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amateur radio

JOURNAL OF THE WIRELESS INSTITUTE OF AUSTRALIA FOUNDED 1910

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★

Members of the W.I.A. should refer all enquiries regarding delivery of "A.R." direct to their Divisional Secretary and not to "A.R." direct. Non-members of the W.I.A. should write to the Victorian Division, C/o. P.O. Box 36, East Melbourne. Two months' notice is required before a change of mailing address can be effected. Readers should note that any change in the address of their transmitting station must, by P.M.G. regulation, be notified to the P.M.G. in the State of residence; in addition, "A.R." should also be notified. A convenient form is provided in the "Call Book".

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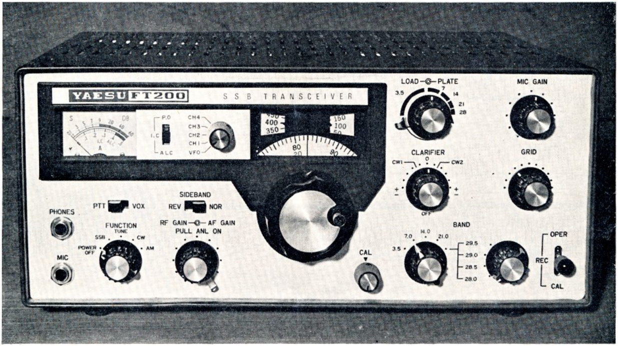
Displayed in multi-colour are two of the Special QSL Cards to celebrate the Cook Bi-Centenary and the Diamond Jubilee of the Wireless Institute of Australia. Further details are given on page 7.



ECONOMICAL SSB! *NEW, from YAESU*

FT-200 FIVE-BAND TRANSCEIVER

A superb quality, low cost, versatile transceiver that you have been waiting for. Covers 80-10 mx; SSB, CW, AM; with a speech peak input of 300 w. Transistorised VFO, voltage regulator, and calibrator. 16 valves, 12 diodes, 6 transistors. PA two 6JS6A pentodes. ALC, AGC, ANL, PTT and VOX. Calibrated metering for PA cathode current, relative power output, and receiver S units. Offset tuning ±5 Kc. Uses a 9 Mc. crystal filter with bandwidth of 2.3 Kc. at —6 db. Selectable sidebands, carrier suppression better than —40 db. Sideband suppression better than —50 db.

Operates from separate 230 volt 50 c.p.s. AC power supply, which includes built-in speaker. A 12 volt DC power supply is planned for later production. Power take-off available for transverters, etc.

Cabinet finished in communication grey lacquer. Panel, etched, satin finish aluminium.

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Imported Yaesu matching Power Supply FP-200, with speaker, $90 inc. S.T.

Other well known Yaesu Models: FTDX-100 Transistorised Transceiver, FTDX-400 Transceiver, FLDX-2000 Linear Amplifier, FLDX-400 Transmitter, FRDX-400 Receiver, FR-50 Receiver, FTV-650 6 Metre Transverter, FF-30DX Low Pass Filter.

Sets pre-sale checked, PLUS Personal 90-day Warranty, PLUS Factory one-year Warranty, PLUS after-sales Service and Spares availability.

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Wireless Institute of Australia
Victorian Division

A.O.C.P. CLASS

Theory:

MONDAY, 18th AUG., 1969

Theory is held on Monday evenings 8 to 10 p.m.

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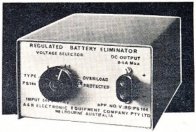
SPECIALLY FOR LARGER BATTERY OPERATED TAPE RECORDERS



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"BREAK-IN" (N.Z.A.R.T.) $2.35 p.a.

We are happy to announce that the W.I.A. can now accept subscriptions to "Break-In", the journal of the New Zealand Association of Radio Transmitters.

Cost: W.I.A. Members only, **$2.35** for 11 issues plus Call Book.

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Subscriptions also accepted for "QST," "CQ," "73," "Ham Radio," R.S.G.B. and A.R.R.L. publications.

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ALSO AMATEUR TYPE CRYSTALS — 3.5 Mc. AND 7 Mc. BAND.

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With the co-operation of our overseas associates our crystal manufacturing methods are the latest.

FEDERAL COMMENT

PLANS FOR 1970 CELEBRATIONS

1970 will be an important year for Australia, two hundred years from when Captain Cook first landed on the eastern coast of Australia. This bi-centenary will be the subject of many celebrations in Australia, and it is not inappropriate that we, as Radio Amateurs, also do something in honour of this occasion.

But next year we have something in addition to celebrate—the **Diamond Jubilee of the Wireless Institute of Australia**. The first steps towards the organisation that exists today were taken in 1909. Our Federal Historian assures me that the Wireless Institute of Australia will, in 1970, be 60 years old. He also assures me that there is no doubt that the W.I.A. can justify its claim to be the oldest radio society in the world. Whether we are or not matters little—what does matter is that we take time to honour those men of the past to whom our great hobby owes so much; and what better year than in 1970 when it is coupled with the very important Cook Bi-Centenary celebrations.

No doubt in sixty years the character of Amateur Radio has changed significantly. The vast technology of a great industry in some way overshadows our hobby today, yet today this industry itself provides so many who are among the ranks of Amateurs. Whilst the character of our hobby may have changed, anyone who has read the contemporary material of the early days of Amateur Radio will be likely to conclude, I think, that the spirit of Amateurs themselves has changed very little. Next year, therefore, we honour not only the Cook Bi-Centenary, but also the Diamond Jubilee of the Wireless Institute of Australia.

SPECIAL PREFIX "AX"

The Federal Council, through the Federal Executive, has made a number of plans, and in this issue of "Amateur Radio" and by simultaneous release throughout the world, I have the honour to announce these plans.

Firstly, from the 1st January, 1970, and until the 31st December, 1970, all Australian Amateur Stations whilst operating on Amateur bands will be able to substitute the special prefix "AX" for the prefix "VK" if the operator so wishes; thus, I can, if I wish, call myself AX3KI. I hope, particularly on international bands, that all Australian Amateurs will make use of this privilege.

QSL CARDS

Secondly, the Australian Tourist Commission is making available 100,000 blank QSL cards. These are printed in four colours and are illustrated with appropriate photographs of typically Australian scenes. They have a text referring both to the Cook Bi-Centenary and the Diamond Jubilee of the Wireless Institute of Australia.

These cards will be distributed through the Divisions. I hope that as many Amateurs as possible, particularly those regularly working on international bands, will have these cards over-printed with their own "AX" call sign.

SPECIAL AWARD

Thirdly, the Wireless Institute will be giving a special Captain Cook Bi-Centenary Award for Amateurs contacting a specified number of stations using the optional prefix "AX" during 1970. The rules of this Award are published on page 7. I hope that this will be a popular Award—I look to Australian Amateurs to do their best to ensure that it is, by using the prefix "AX" and by sending QSLs when requested, and by drawing overseas Amateurs' attention to the existence of the Award when they are talking to them. Details of these plans for 1970 may be found elsewhere in this issue.

EARLY DAYS OF RADIO

Our own journal, "Amateur Radio," will have a series of articles throughout 1970 telling the story of the early years of Amateur Radio in this country.

In making this announcement on behalf of the Federal Council and the Federal Executive, may I record our gratitude to those who have made these plans possible — to the Postmaster-General's Department, to the Controller, Radio Branch (Mr. Carroll), to the Australian Tourist Commission, to the Federal Awards Manager, go our grateful thanks.

Let us make 1970 a great year for Amateur Radio and a great year for the W.I.A. Let us see a record membership in all Divisions; let us see greater activity than ever before on our bands. All of us are Amateurs because we want to be—because we obtain enjoyment from our hobby. Let us honour the past by, in 1970, using our privileges to the full.

Michael J. Owen, VK3KI,
Federal President, W.I.A.

Ayers Rock in Central Australia is the world's largest monolith, $5\frac{1}{2}$ miles around and 1,100 feet high. A sacred place to the Aborigines, whose cave paintings and carvings can still be seen here, Ayers Rock is a major attraction for overseas visitors; it can be reached on air and road tours from Alice Springs, Australia's most colourful outback town.

To Radio...

This QSL confirms our 2 way
SSB/AM/CW/FM/RTTY QSO

On...............mcs. at..............................hrs. GMT

on...

UR sigs. R..................S..................T..................

PWR.............................watts Ant..........................

TNX QSO PSE QSL 73

GREETINGS FROM AUSTRALIA

World famous navigator Captain James Cook discovered eastern Australia in 1770. Two highlights of the bicentenary celebrations will be a London to Sydney air race in December 1969, and in March 1970 Sydney's international exhibition "Panorama of the Pacific". 1970 is also the 60th anniversary of the Wireless Institute of Australia, the world's oldest radio society.

Reverse side of the Special QSL Cards

Wireless Institute of Australia

offers to Overseas Stations and

Australian Stations the

COOK BI-CENTENARY AWARD

To mark the occasion of the 200th anniversary of the discovery of the eastern coast of Australia by Captain Cook in the year 1770, the Wireless Institute of Australia is issuing a Special Award to be known as the "Cook Bi-Centenary Award". It will be available free to any licensed Radio Amateur throughout the world who, during 1970, makes two-way radio contact with the required number of Australian Amateur Stations as set out below.

1970 is also the 60th anniversary of the founding of the Wireless Institute of Australia, the Australian Amateur body which has served the interests of Radio Amateurs since 1910 and is the world's oldest Radio Society.

Because of the special significance of the year 1970, a new prefix will be available for use by Australian Amateurs between 1st January and 31st December, 1970. At the option of the station operator during this period, the VK prefix may be replaced by the special AX prefix.

AWARD RULES

Operation.—Only Australian Amateur Stations using the special AX prefix may be worked for the purposes of this award. Contacts may be made on any band or mode available to Australian Amateur stations. Cross-band operation will not be permitted. No contacts made with ship or aircraft stations in Australian Territories will be eligible, but land mobile or portable stations may be contacted provided the location of the station worked, at the time of the contact is clearly indicated. Operators at all times must operate within the terms of their station licence. All contacts must be made during the period 1st January to 31st December, 1970, inclusive. Contestants may work each station once only during this period for the purposes of this award.

Requirements

Overseas Applicants. — Stations outside Australian Territory must contact 50 different Australian Amateur Stations using the AX prefix during the abovementioned period.

AX Applicants.—Stations within Australia must contact 100 different Australian Amateur stations using the AX prefix, working the required number of stations in each Call Area as per the list below, during the specified period:

AX1	(VK1)	3	Stations
AX2	(VK2)	30	„
AX3	(VK3)	30	„
AX4	(VK4)	11	„
AX5	(VK5)	11	„
AX6	(VK6)	6	„
AX7	(VK7)	4	„
AX8	(VK8)	1	„
AX9	(VK9)	3	„
AX0	(VK0)	1	„
Total	....	100	Stations

Applications.—Stations applying for the Award are **not** to forward QSL cards, but instead should submit a list of the stations worked (in order of Call Signs by Call Areas) plus the following details of each contact: Date, time (G.M.T.), band, mode, report. This list, certified by two other licensed Amateurs plus a statement to the effect that they have sighted the log entries of the applicant, should be sent to:

Awards Manager, W.I.A.,
P.O. Box 67,
East Melbourne,
Victoria,
Australia, 3002.

Applications should be clearly marked "Cook Award" on the back of the envelope containing the check list plus the full postal address to which the award is to be sent. All applications are to be received at the above address no later than 31st December, 1971, as no further entries will be accepted after this date.

Certificates will be forwarded free of charge by surface mail. However, if airmail return is required, eight IRC coupons must be included to cover the extra cost involved.

TOURIST COMMISSION PROVIDES QSL CARDS

The Australian Tourist Commission, following representations by individual Amateurs and subsequently the W.I.A., has provided 100,000 blank QSL cards for the use of Australian Amateurs during 1970.

There are four designs, each a photograph of a typically Australian scene. The scenes depicted are: Sydney Harbour, Ayre's Rock, the Whitsunday Passage in Queensland, and a surf boat. These will be distributed to Divisions, and Divisional Councils will be making arrangements direct with members for their distribution.

The cards were distributed by the Federal Executive proportionately to the number of Amateurs in each State as follows:

N.S.W. Division: 32,000 cards (including the Australian Capital Territory).

Victorian Division: 30,000 cards.

Queensland Division: 11,000 cards.

South Australian Division: 13,000 cards (including Northern Territory).

Western Australia Division: 8,000 cards.

Tasmanian Division: 4,000 cards.

2,000 cards have ueen retained by the Federal Execlutive for distribution to VK9 and VK0 Amateurs.

☆

SPECIAL CALL SIGN GRANTED BY P.M.G.

From the **1st January, 1970**, until the **31st December, 1970**, all Australian Amateur Stations may use the prefix AX instead of the prefix VK.

The use of the prefix AX is not compulsory, but may be used at the option of the licensee concerned. There are no formalities necessary to enable licensees to use this privilege. Individual licensees will not be notified personally of this privilege.

The Controller, Radio Branch (Mr. C. Carroll) has asked the Wireless Institute of Australia to give the matter the widest possible publicity. An early announcement is necessary to enable publicity to be obtained in overseas journals. However, Mr. Carroll points out that it is **not permissible** to use this special 1970 prefix before the 1st January, 1970.

PROJECT—SOLID STATE TRANSCEIVER

PART NINE

H. L. HEPBURN, VK3AFQ, and K. C. NISBET,† VK3AKK*

This article must be prefaced with an apology to readers for its non-appearance in the July issue. It is to be regretted that the writers were just too occupied with the business of earning a living to have had the manuscript in the hands of the printers in time for publication.

In this article the following aspects will be covered:

(a) Coupling the transmit mixers to the p.a. stage described in the June 1969 "A.R.".

(b) Lining up the transmitter to the output of the transmit mixers.

(c) Tuning the p.a.

(d) A two-tone test oscillator.

(e) A suitable output power meter.

COUPLING TO THE P.A.

Reference to Fig. 25 shows that the 9 Mc. s.s.b. inputs to all transmit mixers, the injection frequency inputs and the signal outputs are all in parallel and that the drive control is in the output of the mixers. This system supersedes that inferred in Fig. 17 (April 1969 "A.R.") which shows the drive control in the 9 Mc. s.s.b. feed to the transmit mixers and in Fig. 15 (March 1969 "A.R.") which shows the r.f. outputs of the transmit mixers being switched. This "loss" of a switch wafer is possible because of the relatively low output impedances of the transmit mixers. The appropriate mixer is selected by h.t. switching and diode gating of the injection inputs only. (See Fig. 17, April 1969 "A.R.")

In order to drive the p.a. stage, it is necessary to have some power gain between it and the transmit mixers.

This is obtained by using a Motorola MM1601 as a resistance coupled, untuned amplifier as shown in Fig. 25.

A 2.5K "C" taper potentiometer is used in the input to the MM1601 as a drive level control.

Correct biasing of the MM1601 is provided by the 2.2K/220 ohm bias chain, while a 10 ohm resistor is used as a collector load. Output from this stage is capacitively coupled to the p.a. stage proper.

The 3.3 ohm w.w. resistor, used in conjunction with the 4.7 uF. and 0.047 uF. capacitors in the h.t. decoupling network, is specified because it has a few microhenries of inductance to improve its decoupling efficiency at r.f.

Note that the MM1601 and its associated components are included in the kit of parts detailed in the June "A.R." and explain the **apparent** discrepancy between the two transistors shown in Fig. 25 and the three mentioned in the kit description.

LINING UP THE TRANSMITTER MODULES

In reading the description that follows, the reader is urged to have before him the copies of "A.R." containing the first seven articles in the series as reference will be made to figure numbers and coil/transformer numbers appropriate to the module under discussion.

These articles appear in the November 1968 to May 1969 issues.

It is assumed that v.f.o. has been put on frequency, the heterodyne oscillators are giving output, the carrier oscillator is functioning and that the filter board is operative. Commissioning of these modules was described in the May 1969 article.

It must now be emphasised that the commissioning procedure that follows is based on the possession of the absolute minimum of test equipment. For that reason it is necessarily "rough". For optimum results, access to a wide band c.r.o. which gives a useful response to 30 Mc., and a first class signal generator having an accurately calibrated attenuator are obligatory.

However, this description assumes that only a v.t.v.m. fitted with an r.f. probe and a general coverage receiver having an S meter are available.

Participants in the project are already aware that—under the conditions detailed in January 1969 "A.R."—the project organisers can, and indeed prefer to, carry out the commissioning procedure in Melbourne where the necessary equipment is available to do the job.

Step 1.—The first three units to be connected together are:

(i) The tx audio module.

(ii) The carrier oscillator module switched to "normal" sideband (8,998 Kc.).

(iii) The balanced modulator module.

The microphone gain potentiometer should be set at zero, the 5K audio trimpot on the balanced modulator board set at zero, the 1.5K balance trimpot set at half way, the 3/30 pF. balance trimmer connected to one side of the balanced modulator and set half open, and the 8,998 Kc. 1.5K level trimpot set to about quarter open before power is applied.

Note that it is necessary to have h.t. applied to the rx product detector if good carrier balancing is to be achieved.

With the v.t.v.m. probe on the d.s.b. output of the balanced modulator, apply 9-10 volts of h.t. Varying the 1.5K balance trimpot either side of centre will give a reading on the v.t.v.m. Adjust the carrier balance control for minimum reading. Also adjust the 3/30 pF. balance trimmer in conjunction with the trimpot to give a null.

Once this has been done on the v.t.v.m., loosely couple the d.s.b. output to a receiver set at 8,998 Kc.

Repeat the adjustments to the trimpot and the trimmer until the lowest possible S meter reading is obtained. It should be possible to get the S meter down to about S3-4 with the r.f. gain control on the receiver full open. Then peak the core of L24 (Fig. 13).

It may be necessary to try the 3/30 pF. trimmer on the other side of the modulator to achieve the maximum carrier suppression.

Note that the carrier will be attenuated by a further 15-20 db. or so by the time the signal has gone through the filter.

Checking audio quality and carrier suppression at this stage by the usual "whistle and listen in the receiver" technique may well be misleading, due to direct pick up of the 9 Mc. carrier by the receiver. At the best, such a test is simply a comforting assurance that **something** is working.

Step 2.—Connect in the filter pre-amplifier, the filter board and the 9 Mc. tx amplifier. Connect the v.t.v.m. across the output of the 9 Mc. tx amplifier and apply power.

Unbalance the balanced mixer to give a small indication on the v.t.v.m. and peak the cores of T3 (Fig. 10), L23 (Fig. 10) and T4 (Fig. 11) to give maximum reading. It may be necessary to partially re-balance the modulator to keep the v.t.v.m. reading on scale. Do not re-balance the modulator at this stage.

Step 3.—Couple in the v.f.o. generator, the heterodyne oscillators, the in-

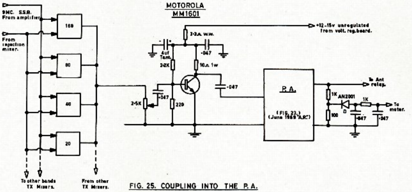


FIG. 25. COUPLING INTO THE P.A.

* 4 Elizabeth Street, East Brighton, Vic., 3187.
† 25 Thames Avenue, Springvale, Vic., 3171.

jection mixer and the tx mixers. Put the v.t.v.m. across the tx mixer outputs.

One band at a time, adjust the coils of each tx mixer to give maximum output. For each frequency range set the v.f.o. to the centre of the Amateur band required, i.e. 1.83, 3.60, 7.07, 14.18 Mc., etc. The corresponding v.f.o. frequencies for the Amateur bands are 10.03, 10.10, 10.07 and 10.18 Mc.

Then wire in place the 2.5K drive level control and check that, for each band, the output of the tx mixers can be varied between zero and maximum.

If it is desired to stagger tune the tx mixer coils, then all the input coils L26 should be peaked in the centre of the required range, all coils L27 peaked at 20% above the lowest end of the range, and all the coils L28 peaked at 20% below the high frequency end of the range.

Step 4.—With the v.t.v.m. across the output of the 9 Mc. tx amplifier, rebalance the modulator for best carrier suppression.

Step 5.—Set the 5K trimpot on the balanced modulator board to about half open.

Connect a 50 ohm variable reluctance microphone to the tx audio module and set the tx audio level control to about quarter open.

With the v.t.v.m. across the output from the transmit mixers, there should be a very positive indication of output when whistling into the microphone. There should be no indication of output when the audio level control is zeroed.

To this stage all that can be said is that output (hopefully, intelligible s.s.b.!) is available. Without a c.r.o. the waveform of the signal cannot be checked but judicuous use of the station receiver should enable some judgment to be made on the quality of the output, its frequency and the presence of unwanted signals or instability.

Participants are again reminded that optimisation, trouble-shooting and correct adjustment can be done for them as a free project service.

TUNING THE P.A.

Several strong recommendations must be made before the p.a. board is coupled in or power is applied.

(i) The output from the tx mixers must be clean. A two-tone test oscillator and a c.r.o. are required to ensure this is so.

(ii) The p.a. **MUST** be run into a 50 ohm resistive power meter as a load. Light bulbs and antennae of unknown impedance are out.

(iii) The power supply should, for the initial tune up, be protected. That is it must cut out if a pre-determined current is drawn by the p.a. Once the tune-up procedure has been carried out, any normal source of 12-15 volts can be used.

(iv) The tune-up should be done on a two-tone test signal, although unbalancing of the modulator can be used as a last resort. (See paragraphs under Power Meter heading.)

Provided these requirements can be met, tune-up can proceed. Refer to Fig. 23 in June 1969 "A.R." for coil and capacitor numbers.

Put a 0-3 amp. meter in the unregulated h.t. lead from the supply to the p.a. Set the drive control at zero. Set all variable padders (C3 and C4) at full capacity. Set the slug of L1 fully in. This applies to each band. Set the tx audio control to quarter open so that a two-tone output is available from the tx mixers. Terminate the p.a. in a 50 watt resistive power meter.

Apply h.t. and note the quiescent current drawn. It should be about 1.3 amps. Three steps follow:

(1) Carefully advance the drive control until the quiescent current JUST starts to increase (i.e. drive is being applied to the MM1602).

(2) Adjust the core of L1 outwards (i.e. in the direction of lower inductance) until the total p.a. current JUST increases again. **Do not attempt to peak the current at this stage.** Peaking will take place only AFTER the MM1603 output circuits are adjusted.

(3) Decrease the capacity of C3 until the OUTPUT of the MM1603 peaks on the power meter.

Increase the drive level by a **small** increment and repeat steps 2 and 3.

Again increase the drive slightly and adjust L1 and C3.

Repeat this procedure using small drive increments until about 10 watts p.e.p. are indicated on the power meter. Then adjust L1 and C3 for a peak in output.

Finally, the drive level is set so that it is just below the "flat topping" point of the p.a. and C4 adjusted for maximum output consistent with the best waveform. A c.r.o. is definitely required for these last two adjustments.

Stress has been laid on the "softly! softly!" approach and on the need to adjust correctly. But it should be borne in mind that once this adjustment procedure has been carried out it does not need to be repeated. Once adjusted, that adjustment will hold for each band and each position in the band. There are no coventional "tune" or "load" front panel controls.

Re-adjustment will be necessary if the antenna load applied to the transmitter varies too much from 50 ohms resistive. Again the warning is sounded against the use of other than properly matched antennae—not so much this time from the point of view of damage to the p.a., but rather to avoid a very considerable drop in output.

The next two sections may assist those who, for this project or not, require some ideas on signal sources or power meters.

TWO-TONE TEST OSCILLATOR

Fig. 26 gives the circuit diagram of the two-tone test oscillator used as an audio signal source for alignment and checking of the project transmitter.

Two RC oscillators provide outputs on either 1.5 Kc. or 900 c/s. The two output levels are independently adjustable by means of the 22K trimpots and an MPF102 source follower is used as a buffer stage.

Two outputs are provided, one at high level for use where a volt or two of tone is required, and a low level output designed to plug straight into the microphone socket of the project transmitter.

Switching is provided so that either audio frequency on its own, or the two together can be selected. It is contained in a die cast box and the output socket can be wired so that the h.t. requirement can be obtained from the project transceiver.

At this point no steps have been taken to produce a kit for this piece of equipment but, since the circuit board layouts, etc., have been done for the writers' own use, kits can be made available should they be asked for. A "guesstimate" price would be around $18 complete with diagrams and instructions.

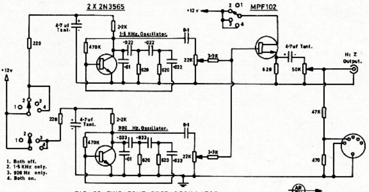


FIG. 26. TWO TONE TEST OSCILLATOR.

POWER METER

As a result of the comments made in the June 1969 issue, regarding power meters, several letters have been received asking for details.

The one used by the writers is a first class low-priced meter made from a kit set marketed by Horwill Electronics, of 45 Edmonds Ave., Burwood, Vic.

It comes complete with all parts, including an internal resistive load, meter and two-position switch to select either a 5-watt or 50-watt f.s.d. On test, it is as accurate at 200 Mc. as at 2 Mc. and at the higher frequency has an s.w.r. of better than 1.5 to 1. The kit price is extremely resonable. Those

(Continued on Page 23)

THE EXPANDED LAZY-H ANTENNA*

JOHN J. SCHULTZ, W2EEY/1

The author presents a simple variation of the Lazy-H Antenna which both improves its gain and makes the feed point impedance a more convenient value. For those interested in a directive, wire-type antenna with good gain, the Expanded Lazy-H Antenna is worth considering.

SOME time ago a wire type antenna which the author had erected came down during a storm. The supports for the antenna, being two tall trees, fortunately didn't come down. It was desired to quickly erect a directive antenna for 10 metres and the author's attention was directed by another Amateur to the old standby lazy-H design (Fig. 1). It is basically a one-band antenna of moderate gain, although with resonant feeders multi-band operation is possible.

A little checking of antenna literature produced some figures on the gain of the antenna as a function of the spacing between the upper and lower set of elements. A three-eighths wavelength spacing produces only 4.4 db. gain, but the gain goes up to 5.9 db. with half wavelength spacing and 6.7 db. with five-eighths wavelength spacing. For only quarter wave length more spacing, a significant increase in gain is produced and it was decided to build the antenna with this spacing.

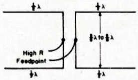


Fig. 1.—Conventional Lazy-H Antenna configuration.

Looking further at the lazy-H, it was seen to consist of two one wavelength colinear elements spaced and fed in phase. A single colinear element by itself does not produce very much gain (about 1.9 db.) and that is why it is rarely used alone. However, it was remembered that a single colinear element is frequently slightly lengthened to 1.3 wavelength, the greatest length that can be used before the broadside antenna pattern splits into lobes, to form a so-called extended double zepp antenna. The gain increases from 1.9 to 3.0 db. for this small increase in antenna length.

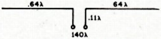


Fig. 2.—Extended Double Zepp Antenna with impedance stub.

Unfortunately, lengthening of the simple colinear antenna into an extended double-zepp produces an impedance at the antenna terminals having a reactive component. The addition of a small 0.11 wavelength stub, however, as shown in Fig. 2, takes care of the reactive component and presents a 140 ohm resistive termination. Fig. 3 shows how the extended lazy-H is formed using two extended double-zepp elements.

A half wavelength phasing line is used between the antenna elements. The phasing line is twisted once since a phase reversal takes place every half wavelength along the line and the twist is necessary so that the two elements will be fed in phase. The half wavelength line reflects the same impedance that it is connected to without change so point A in Fig. 3 presents basically the impedance at the termination of the two extended double zepp antenna stubs in parallel. The 70 ohm impedance thus produced allows direct connection of point A to a standard 50 or 70 ohm co-axial cable. Of course, on 10 metres there is some advantage to using a coupling device to transform the unbalanced co-axial line to a balanced form for connection to the antenna. A balun or commercial transformer can be used with a 1:1 impedance ratio. The author did not use any matching device only because of the desire to quickly erect the antenna.

The co-ax. feedline is simply connected across the 300 ohm line at the correct point without having to break the line. The insulation on the line is stripped away for about ½" on either side in sequence and the co-ax. leads soldered to the line. The whole connection is covered with electrical tape or heat shrinkable tubing.

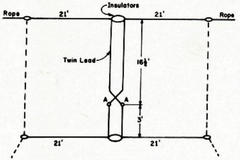
The co-ax. is run downwards so moisture from the line above does not enter the connection. Nylon rope is used to connect the ends of the upper element to their supports. Inexpensive plastic clothesline can be used to connect between elements at the ends and hold them in position since only enough stress need be applied to keep the elements reasonably taut.

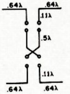
RESULTS

The antenna appeared to work very well in operation. No formal gain measurements were made, but judging from comparison reports, the gain was estimated to be from 7.5 to 8.0 db. It definitely is felt that several db. extra gain was achieved by using wide spacing between elements and having the elements of the extended double-zepp form. Certainly the extra gain was achieved for a minimum investment in wire and other parts.

As was mentioned before, the antenna is basically a one-band type. However, if erected for permanent installation it might be desired to use it as a multi-band antenna by feeding it with a resonant, balanced feedline. The 10 metre model may still produce a small amount of gain on 15 metres if used in this manner and should certainly be at least as effective as a dipole on 20 metres, perhaps a bit better.

Fig. 3. Expanded Lazy-H Antenna with dimensions for 10 metre model.





CONSTRUCTION

Construction of the antenna is simple and straightforward. Copperweld or phosphor bronze wire is used for the antenna elements. Standard 300 ohm twinlead (or the transmitting type for high power) is used for both the stubs and the half wavelength phasing section. There is, of course, then no distinct point physically where a connection must be made between the stubs and the phasing section. The section of line from the upper element must still be twisted one turn, however. The dimensions which are given in Fig. 3 take into account the velocity factor of the transmission line as must be done if the antenna is constructed for another band.

* Reprinted from "CQ," November 1968.

Transistors on Computer Circuit Boards

RON BROWN, VK7ZRO, and R. LEO GUNTHER,† VK7RG*

Computer circuit boards have been available for several years in this country and have gained wide popularity because they provide a very inexpensive source of components, and even of whole circuits for the experimenter. Although characteristics of some components have been described in various issues of "The Australian E.E.B.," there has been a need for a more detailed examination of the characteristics of the transistors found on the boards. Tests of this type have been performed by a number of people, and this article is an attempt to summarise their work.

LIMITATIONS OF THE DATA

It must be emphasised that the material presented here is not a compilation of precise data of the kind you would find in the commercial Technical Transistor Manuals. The present tests are of simple type and in many instances the information is very sketchy, owing to insufficient numbers of samples being available. We believe, however, that the material is reasonably representative, and that the figures presented may be an approximate guide to what to expect.

In the charts presented here, it must be noted that there is a fairly wide range of variation of ratings from one transistor to another for a given type number. This means that if the rating is not tested for every transistor used, the experimenter must assume the most pessimistic value, i.e. the lowest one stated in these tables.

More performance can be extracted from a transistor if its exact characteristics are known. This means that they ought to be tested. This is not difficult, and suitable procedures have been described in various places in the literature.[1] Testing is desirable for another reason: not only is there a certain chance of finding an occasional bad transistor, but it is possible to damage a transistor if excess heat is applied while desoldering. This is particularly marked for F_T of the Alloy Diffused types; the frequency response can be degraded appreciably by overheating.

ABSOLUTE MAXIMUM RATINGS

Above all, it must be recognised that all breakdown voltages specified here are **Absolute Maximum** values. This means that no built-in safety factors are included, as you would find in manufacturer's specifications. We believe that statement of Absolute Maximum ratings is more useful to the experimenter because they allow him to provide safety factors appropriate to individual conditions. There is a widespread misconception about the flexibility of the ratings of semiconductors, a carry-over from valve technology. When the ratings of a transistor are definitely exceeded, the transistor will die, no fear! "There is no such thing as a flexible transistor voltage rating, though it may appear so because of the necessity for rating them conservatively to satisfy the human desire to get something for nothing!"[2] Much better reliability can, therefore, be obtained by considering the Absolute Maximum ratings, and applying realistic safety factors.

For example, in a circuit running on d.c. only, with no source of transients one might provide a voltage safety factor of, say, 20% above maximum expected peak. When transients are present, as with an inductive source or load, the voltage safety factor may have to be 50-100% or more, depending on how well the transients are suppressed. A transistor operating as an emitter follower in a conventional d.c. regulator could run full current into a resistive load, but 25% less into a capacitative one because of the high peak currents of the latter. Increased collector current also reduces voltage ratings.[3]

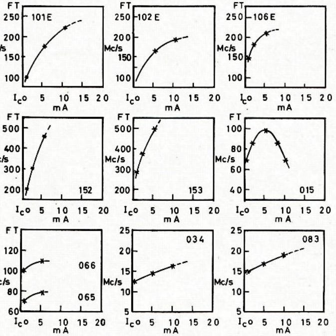


Fig.1. Variation of FT VS Ic at Vce = 5V

VOLTAGE RATINGS

A word about the voltage ratings for transistors is in order. It is not as simple as specifing a p.i.v. rating for a diode, because the various electrodes of a transistor interact. When you measure the voltage breakdown in the reverse direction between collector and base, the highest value is obtained because the emitter is not connected, and the rest of the transistor is not operating. This is the BV_{CBO} (breakdown voltage between collector and base, emitter open), and is often specified as a commercial rating, because it looks good. In the following discussion, it can help considerably if you look at Fig. 94, p. 84 of the R.C.A. "Silicon Power Circuits Manual," a superb book for anyone interested in semiconductors, particularly for r.f. applications.

A more practical rating is the BV_{CES}, taken between collector and emitter, with base shorted to emitter. Although the base is now in the circuit, it is not forward biased, and has negligible effect on the current. For this reason, for all practical purposes, BV_{CES} can

* 215 Carella Street, Howrah, Tas., 7018.

† 32 Waterworks Road, Dynnyrne, Tas., 7005.

1—"E.E.B.": 6, 9, 11/67; particularly 9/68. "A.R.": Dec. 1966, p. 3. "Break-In": July 1966, p. 184. "G.E." and "Motorola Transistor Manuals." Several in "Radio-Electronics" and in "Electronic World" during the past two years, varying degrees of complexity. "The Curve Master," "Ham Radio," March 1968, p. 40, is particularly good, using a c.r.o. If a c.r.o. is not used, probably even better is the Universal Transistor Tester described in "Coryra," Nov. 1968, which is one of the few instruments which tests both gain and voltage. "Coryra" is an Australian journal which often contains good material of interest to experimenters. "E.E.B." also plans a Review of Transistor Testing.

2—"Efficiency Trade-offs in R.F. Power Amplifiers," "E.E.B.," May 1968, p. 46. See also "Why Abuse Semiconductors?" "E.E.B.," September 1968.

3—See "Second Breakdown," p. 84, 91, of R.C.A. "Silicon Power Circuits Manual."

NPN TO-18 MESA GERMANIUM

Types 152 and 153

$F_T > 175$ Mc. at 1 mA. (see Fig. 1)
($P_C = 50$ mW. at 25°C. case)
$BV_{CEO} = 50\%$ BV_{CBO}.
$BV_{CBO} > 20$ V.
$I_{CBO} < 2$ μA. at 5 V.
(I_C max. = 50 mA.)
$BV_{EBO} > 4.0$ V.
β min. = 30, β av. = 80 at 1 mA.
Figures in brackets are estimated.

NPN TO-18 SILICON PLANAR

Types 2B8 and 193

($F_T > 150$ Mc. at 10 mA.)
($P_C = 200$ mW. at 25°C. case)
$BV_{CEO} = 30\%$ BV_{CBO}.
$BV_{CBO} > 25$ V.
(I_C max. = 50 mA.)
$BV_{EBO} > 4.0$ V.
β min. = 30, β av. = 55 at 1 mA.
Figures in brackets are estimated.

PNP TO-18 MESA GERMANIUM

$F_T > 100$ Mc. at 1 mA. (see Fig. 1)
($P_C = 50$ mW. at 25°C. case)
$BV_{CEO} = 50$ to 60% BV_{CBO}.
$I_{CBO} < 5$ μA. at 5 V.
(I_C max. = 50 mA.)
Collector connected to case.

Type	β @ 1 mA. Min.	β @ 1 mA. Av.	BV_{CBO} Min.	BV_{EBO} Min.
045	15	20	15	1.0
101, 101E, 124E	20	35	20	1.5
102, C32/931	25	40	20	2.5
102E Texas	50	60	15	2.0
102E Motorola	40	50	40	3.0
103	10	20	25	3.0
106E		60	50	4.0
141		80	80	6.0
260		30	40	3.0

Figures in brackets are estimated.

TO-5 — GERMANIUM — ALLOY DIFFUSED

$F_T > 70$ Mc. at 1 mA. (see Fig. 1)
$BV_{EBO} > 3$ V.
$I_{CBO} < 3$ μA. at 5 V., 25°C.
Derate P_C at about 5 mW./°C.
N.F.: Audio-high/r.f.-low.
High speed non-saturating switches.
$BV_{CBO} \approx BV_{CES}$.
$BV_{CEO} = 30$ to 60% BV_{CBO}.
V_{CE} (sat.) ≈ 1.0 V.
T_J max. 75°C.
Base connected to case.

PNP	NPN	P_C Max. at 55°C. Case	I_C Max.* mA.	β Min. at 1 mA.	β Av. at 1 mA.	BV_{CBO} Min.
015, 016, 018	065, 066, 068	35 mW.	20	30	60	70
032	082	35 mW.	20		(70)	(100)
	089	(200 mW.)	600		100	(90)
	091	Finned (500 mW.)		20	30	100
	092	Large H.S. (3 W.)				100
	093			25	60	150

* Current at which β falls off rapidly.
Figures in brackets are estimated.

PNP POWER TRANSISTORS

Type	Case	β Av. @ 1	BV_{CBO}	BV_{EBO}
028 (2N1038)	Tall TO-5	50	40	20
036	TO-3	80	75	45
042	TO-3	50	100	50

$BV_{CES} = 80\%$ BV_{CBO}.
$BV_{CEO} = 30$ to 60% BV_{CBO}.
Figures in brackets are estimated.

ALLOY JUNCTION — TO-5 — GERMANIUM TRANSISTORS

$F_T > 5$ Mc. at 1 mA. (see Fig. 1)
$BV_{CES} \approx BV_{CBO}$.
V_{CE} (sat.) < 0.3 V.
T_J max. 75°C.
Derate P_C 5 mW./°C. for low power types.
$BV_{EBO} \approx BV_{CBO}$.
$BV_{CEO} = 30$ to 50% BV_{CBO}.
$I_{CBO} < 5$ μA. at 5 V., 25°C.
Base connected to case for most transistors.

PNP	NPN	P_C at 55°C. mW.	I_C Max.* mA.	β Min.	β Av.	BV_{CBO} Min.	Computer Application
013	063	55	50	30	70	30	100 Kc. Switch.
014		55	(50)	50	70	50	45 V. Neon Drive
025	075	55	100	20	30	30	G.P. Switch.
026	076	(55)	(100)	40	50	70	
030	071, 086	(200)	300/400	30	100	30	High Current Switch and Core Driver.
033, N593	083	55	100	20	80	30	G.P. Switch.
034		55	100	40	90	30	G.P. Switch.
035		55	(100)	40	60	30	
044		(55)	(50)	40	60	80	
	099, 167	(55)	(50)	40	70	30	
125		(55)	(50)	(80)	100	60	

* Current at which β falls off rapidly.
Figures in brackets are estimated.

DIODES

Germanium, Glass Case, I_D max. 25 mA.

BV_{DR}	Letter Identification	Colour Identification
10 V.	9D5	
15 V.	GF.	
20 V.	BX, FB.	Br-Br-Bk.
40 V.	DJ, AA, F, DH.	
50 V.	AN, GH, CJ.	O-Bk-Bu, Bu-Bk, R-W-Bk-R, Y-O-G.
70 V.		G-Bu-G-R.

Silicon, Glass Case, I_D max. 150 mA.

BV_{DR}	Letter Identification	Colour Identification
70 V.	GG, FH.	Br-O-O-Gr.
90 V.	AU, CO.	
140 V.	DD, BT237.	
250 V.	AL.	
400 V.	CL444.	Gr-Bu-Gr.

Silicon Power, Epoxy Case

BV_{DR}	Letter Identification
600 V.	AM.

Zener

BV_{DR}	Letter Identification
10 V.	209002.
28 V.	SV3372.

be taken to be nearly equal to (or perhaps slightly less than) BV_{CBO}. The difference is greater as the power rating of the transistor increases, but even for big power types it is usually only about 20%.

When the base is not connected to anything, a small amount of current will leak to it from the collector and this will increase collector current and will decrease the voltage at which a given breakdown current flows. Thus, the BV_{CEO} is appreciably less than the BV_{CES}, but for small transistors lies fairly well in the range, BV_{CEO} = $0.3BV_{CES}$ to $0.5BV_{CES}$. Evidently, therefore, if you want high transistor voltage rating, there ought to be a low resistance between base and emitter. How low?

If you start with base shorted to emitter, and gradually introduce resistance between them, the collector-emitter breakdown voltage rating gradually decreases from BV_{CES} at 0Ω to BV_{CEO} at infinite resistance; this is shown in Fig. 3 for representative computer board types. You can see that BV_{CES} is approached when R_{BE} is < 10K for TO-18 types, < 3K for most TO-5 types, and still lower for higher power transistors; it can be < 100Ω for 036 and 042. When a given value of R_{BE} controls breakdown voltage, the latter is called BV_{CER}.

BV_{CER} is the really practical value, because it shows the behaviour in a real circuit. In a class C amplifier with link coupling to the base, R_{BE} = O, and the rating is BV_{CES}; in a class A amplifier with appreciable R_{BE}, it can be quite a lot lower. Unfortunately, the BV_{CER} curve varies considerably from one transistor to another, and there is no simple way to predict it. If you do not test it, and if R_{BE} is not obvious from the circuit, you must assume the most pessimistic value, namely the lowest value of BV_{CEO} (or about 30% of BV_{CBO} given in the Tables here). For this reason, and for the others mentioned above, it is always wise to test your transistors and to assign two values to each transistor you test: BV_{CES} and BV_{CBO}. And take note of R_{BE} in the circuit to be used.

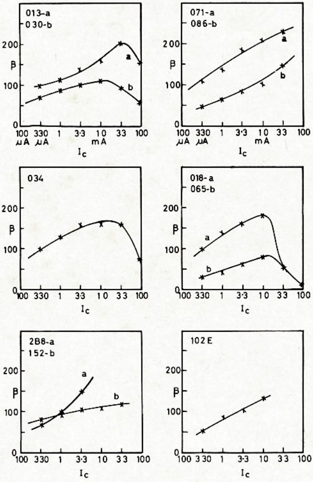


Fig. 2. Variation of B with I_c B at 1KHz and Vce = 6V
I_c in μA and mA

BV_{EBO} is the zener breakdown of the reverse-biased base-emitter junction. It is generally of no particular interest for the Alloy Junction types (033, 083, etc.), which have a symmetrical geometry about the base chip, and which have BV_{EBO} about the same as BV_{CES}. For the Alloy Diffused, Mesa, and Planar types, however, the very low base-emitter breakdown voltage poses a hazard, and care must be exercised when driving them in class C operation. This is an important difference between transistors and valves in r.f. power service.

It should be noted that "Breakdown Voltage" as used here does not mean that the transistor will disappear in a cloud of dust when the rating is exceeded. There are two breakdowns, and this first one is reversible. You can measure it simply by applying reverse voltage until a small current flows, as long as that current is not excessive (e.g. < 100 uA. for TO-5 case types, < 5 uA. for TO-18 case). Be sure to limit the current by a large series resistor during the test.

GRAPHS, ETC.

The graphs presented in Figs. 1 and 2 shows the characteristic of one "average" transistor, each, rather than being the average of a number of transistors. They will be useful only as a guide to characteristics. In Fig. 3, the effect of R_{BE} on collector-emitter voltage breakdown has been investigated, as described above, and each curve represents more-or-less typical behaviour for groups of types as indicated. A similar type of plot appeared in older editions of the "G.E. Transistor Manual." The curves vary widely from one transistor to another, for a given type.

COMMERCIAL EQUIVALENTS

Early in these tests it was realised that in most, if not all cases, there were no commercial equivalent types of transistors. This resulted in a prodigious exercise in testing, and gave us an appreciation of the fact that all characteristics can vary widely indeed between individual units.

Only the characteristics of selected computer board transistors are presented here. Details of other components on the boards are described in the notes supplied with boards ordered from the Tasmanian Division of the W.I.A.

Work is still proceeding at a slow pace to fill in some of the gaps in the tables, but in the meantime the information provided here may be useful to help you find applications for these very nice transistors.

A subsequent article in "A.R." will amplify some of the technical aspects of subjects mentioned here. Another will describe some circuits using computer board transistors. Articles on this subject have also appeared in "The Australian E.E.B." and in "Coryra". "Coryra," in particular, has featured a number of interesting audio and r.f. circuits using computer equipment during the past year.

We wish to express appreciation for help and advice received from R. S.

Maddever, and from an engineer who wishes to remain anonymous because of his work.

SYMBOLS USED

I_{CBO}: Leakage current (uA.), collector to base, with emitter open.

BV_{CBO}: Breakdown voltage, collector to base, with emitter open.

BV_{CEO}: Breakdown voltage, collector to emitter, with base open.

BV_{CES}: Breakdown voltage, collector to emitter, with base shorted to emitter.

BV_{EBO}: Breakdown voltage, emitter to base, with collector open.

BV_{CER}: Breakdown voltage, collector to emitter, with base-emitter resistance as shown.

BV_{DR}: Diode reverse breakdown voltage.

I_D: Forward diode current (Avg.).

R_{BE}: Circuit resistance between base and emitter.

P_C: Power dissipation.

F_T: Transition frequency. $F_T = (f)(h_{FE})$ when f is above $f\alpha_E$. Maximum usable frequency is usually about 30% to 50% of F_T for common-emitter operation, or about F_T for common-base.

Power dissipations (P_C) are for case at temperature indicated; maximum usable power dissipation will depend on the ability of the heat sink (or air) to keep the transistor temperature down to the value indicated. Derating factors may be approximated by consulting manufacturer's Data Sheets for similar types.

Transistor parameters and the various factors influencing them are well discussed in the following references:

"G.E. Transistor Manual," any edition, but the later the better.

"R.C.A. Transistor Manual."

"R.C.A. Silicon Power Circuits Manual."

"Motorola Power Transistor Handbook."

"Grandmas Tests" series in Vol. III. (1967) of "The Australian E.E.B."

TVI—IT CAN BE ELIMINATED... WELL, NEARLY ALWAYS

We have seen many answers to the t.v.i. problem, some good, others excellent. This article claims to be neither, just simple, cheap and easy to fit.

Recently becoming the proud owner of a Swan 350C, I was (temporarily) plagued by a problem, which up until now, hadn't raised its ugly head. I had heard people say they had been troubled by t.v.i. and b.c.i., but I had not experienced it for myself.

So far we have maintained good relations with the neighbours (we have to, got the 80 metre dipole anchored to his chimney), and so when said neighbour battered on the shack door mumbling incoherently about no t.v. picture, I was a little taken aback.

We were in the middle of a QSO with a mobile out in the middle of nowhere and an engineer friend, and so we pleaded for any ideas. Back comes the engineer type and suggests a remedy—filters, no Sir, too expensive; just a simple 2-turn coil (18 gauge wire) wound on a pencil, and placed across the antenna terminals on the back of the t.v. set. Turn to Channel 0 or to Channel 2, whichever is your lowest channel, and make sure that the picture quality hasn't been affected. You may require 3 turns for Channel 0 country). Back on the air, stoke up the linear, and instantly, no t.v.i.

I have silenced two neighbours, and all for no cost at all, and it definitely does work.

One warning. When the t.v. technician comes to repair neighbour's t.v. at any time, best warn neighbour that the technician will have a fit when he sees the coil on the antenna terminals and will probably start to give off with all sorts of double talk about expensive repairs to tuners and the like. I can assure you that no such damage can possibly occur.

In very weak signal areas, this method may not work, I haven't tried it other than at home, but if it does work, then our country cousins will also gain.

—David Priestley, VK6ID.

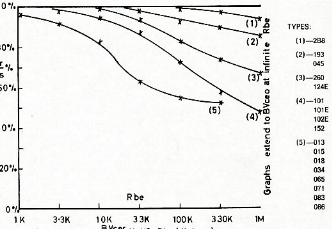


Fig3. Variation of $\frac{BVcer}{BVces}$ % VS Rbe (Kohms)

I.T.U. CONFERENCE

7th JUNE, 1971

Federal Executive have been advised that the Administrative Council of the International Telecommunication Union (I.T.U.) decided that a **World Administrative Radio Conference for Space Telecommunications** should open in Geneva on 7th June, 1971, and last for about six weeks.

The agenda will be the following:

To consider, revise and supplement as necessary, existing administrative and technical provisions of the Radio Regulations and adopt, as necessary, new provisions for radio-communcation services, in so far as they use space radio techniques, including those for manned space vehicles, and for the radio-astronomy service, so as to ensure the efficient use of the spectrum.

To consider, revise and supplement as necessary, the Radio Regulations to provide for the use of space radio techniques by the Aeronautical Mobile and Maritime Mobile Services, for communication as well as for radio-determination purposes.

To consider, revise and supplement as necessary, the existing Table of Radio Frequency Allocations in the Radio Regulations for radio-communication services, in so far as they may use space radio techniques and the radio-astronomy service.

To consider, revise and supplement as necessary, the existing provisions pertaining to the technical criteria and the procedures for frequency sharing between space and terrestrial services, and to establish technical criteria and procedures for frequency sharing between space systems.

To consider the feasibility at this time of co-ordinated frequency planning for radio-communication satellites, including those placed on the geo-stationary orbit, and to take such action as is deemed appropriate.

To make only such consequential changes to the Radio Regulations as are essential for the effective implementation of the decisions of the Conference.

To adopt such Resolutions and such Recommendations related to the foregoing, as may be necessary.

The Institute has no further information to offer at this time, but will be evaluating the agenda in relation to the presently held Amateur allocations, and ultimately will participate in local discussions when formal proposals are being drafted.

Your Divisional Council will be calling on you to provide certain information from time to time—please give them your co-operation.

The Institute's I.T.U. representative at this time is Air Commodore A. G. Pither, VK3VX, and a member of Federal Executive.

When information is available he will provide the latest news through "A.R."

P. Williams, VK3IZ,
Federal Secretary, W.I.A.

Measuring Power Input and R.F. Power Output*

DAVID P. SMITH

ONE can still measure the power input to a c.w. transmitter by holding the key down and multiplying the d.c. plate current to the final stage by the d.c. plate voltage. Power output could be determined by I^2R using the direct reading on an r.f. ammeter and having a correctly matched load. A c.w. transmission is the only type of transmission where this type of simple measurement can be made and, even then, it is deceptive because it really defines the power conditions under non-keyed conditions only.

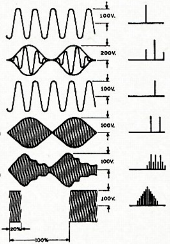
There are at least three types of power measurement which can be used to distinguish the power level in various unmodulated and modulated waveforms: carrier power, average (heating) power, and peak power. Each is important not only to comply with transmission regulations, but also in making the proper choice of the rating for transmitter and transmission line components. The relationship between the various power measurements is often not a simple ratio and wattmeters as well as other instruments may indicate only one power measurement directly.

● As modulation waveforms become more complex, perhaps someday including digital forms, one's view of power measurements requires a more generalised approach in order to avoid confusion.

TRANSMISSION WAVEFORMS

Not all Amateurs have the equipment necessary to view actual transmission waveforms and must rely upon meter indications for transmitter adjustments. However, one can easily become too dependent upon meters and not realise the actual content of a transmission waveshape. As one uses meters, therefore, it should be realised that, in general, they indicate only indirectly and partially what is really happening.

Fig. 1 shows the envelope waveforms, spectrum presentation and a tabulation of power measurements for various types of unmodulated, modulated and keyed waveforms. It is assumed that the waveforms are produced across a 50 ohm load and the voltage levels shown are such as could be measured on a calibrated oscilloscope display.



	Carrier Power	Average Power	Peak Power
Unkeyed CW	100	100	100
AM, 1 Tone 100% Modulated	100	150	400
SSB, 1 Tone	—	100	100
SSB, 2 Tone	—	50	100
SSB, Voice (USB)	—	20-25	100
Pulse	—	20	100

Fig. 1.—Power levels for various unmodulated and modulated waveforms. The power levels are calculated for the waveform amplitudes shown across a 50 ohm load.

By realising the characteristics of the waveform that one is concerned with, however, it is possible to derive the relationships between the various types of power terms and to correctly interpret the indication which a meter, used to measure either power input or output, indirectly produces.

To clarify the various power terms, the waveforms produced by common modulating techniques are first discussed. Then, the reaction of various meter indicating devices to the power levels contained within these waveforms is examined as a basis for practical methods of measuring r.f. power input and output levels.

The unkeyed c.w. waveform results in carrier, average and peak envelope powers of all the same value. Intuitively, one can see that the average and carrier powers should be the same since the signal is the carrier and it doesn't vary. However, the value of the 100 watts p.e.p. may not seem to correlate immediately with the 100 volt peak voltage shown on the waveform. The reason is that for a power figure, r.m.s. voltage must be used. The r.m.s. value of the peak voltage is 100 $\times$ 0.707 and the peak envelope power is:

$$\text{p.e.p.} = \frac{V_{RMS}^2}{Z} = \frac{(100 \times 0.707)^2}{50} = 100 \text{ watts.}$$

Peak envelope power is **not** simply peak voltage squared divided by the impedance as many Amateurs believe. If one used such a relationship and worked "backwards" to determine, for instance, the peak voltages that various components should withstand for a transmitter of a given p.e.p. output, it would result in using under-rated components. For 100 watts p.e.p., for example, components would be chosen for a 70 volt peak rating whereas a 100 volt peak rating is necessary.

A.M. WAVEFORMS

The single tone modulated a.m. waveform presents peak, carrier and average powers which all differ. Since it is assumed that the waveform represents a 100 watt output transmitter which is modulated 100% by a single tone, the carrier power must remain 100 watts since, by the definition of amplitude modulation, it does not vary. The peak power is calculated the same as in the c.w. case, using the 200 volt peak of the modulated waveform. The average power can be calculated by an analysis of the waveform but, for simplicity, the relationship is shown in the form of the graph of Fig. 2.

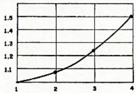


Fig. 2.—Graph used to relate various power levels for an amplitude modulated carrier. It is not applicable to s.s.b. transmission.

From this graph, since the peak power is four times the carrier power, the average power is 150 watts. This average or heating power would be the dissipation a dummy load used with the transmitter would have to handle but transmission line insulation, etc., would have to be calculated on the basis of the peak power.

S.S.B. WAVEFORMS

The single tone modulated s.s.b. waveform is exactly the same as the unkeyed c.w. waveform and all the same power levels apply. One can get involved in semantics as to whether the carrier power should be zero or 100 watts. Compared to the c.w. case, it can be regarded as 100 watts. Compared to the a.m. case, it should be regarded as zero.

The two-tone modulated s.s.b. signal presents a different set of power levels. The peak power is calculated from the

* Reprinted from "CQ," February, 1969.

peak voltage of the waveform. The average power can be calculated by assuming a carrier power that corresponds to the single tone a.m. modulated waveform as a rough approximation, but the single sideband and a.m. waveforms are **not** the same. The approximation would produce an average power of about 40 watts while the actual average power for the two-tone s.s.b. signal is 50 watts. Tests are rarely made on a s.s.b. transmitter with more than two tones (where the 2/1 peak to average power ratio applies), but a graphical relationship could be presented which would show the peak/average power ratio decreasing to 3/1 with three tones and then slowly levelling out (see Fig. 3).

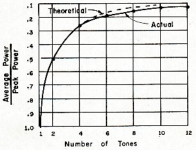


Fig. 3.—Use of two equal amplitude test tones produces s.s.b. average/peak ratio of 1/2, four tones a ratio of 1/4, etc. For a high number of tones the actual ratio is slightly different than expected because statistically for brief instants the tone amplitudes will combine in such a manner that the rated peak power is exceeded.

The relationship of the average to peak power in a voice modulated s.s.b. system depends a great deal upon voice characteristics and equipment characteristics. Usually, the average is taken as 20-25% of the peak value.

PULSE WAVEFORMS

The peak power of the pulse or digital waveform is calculated the same as for the other waveforms. The average power is simply calculated from the percentage of time that the pulse is transmitted. In the example shown, the pulse is present 20% of the time and so the average value is 1/5 of the peak value. Usual keyed c.w. is about 50%.

The usefulness of the various power level measurements depends upon what components are being chosen. Output circuit and antenna components must be rated to withstand the peak voltages encountered with any modulation system for a given peak power level. Tube dissipation, cooling requirements, power transformers, etc., must be chosen on the basis of a sustained average power for their minimum requirements.

METER MEASUREMENTS

The usual D'Arsonval movement used in meters for measuring plate current, plate voltage, relative r.f. output, etc., is essentially an average reading device. This factor is important because it is often used to measure waveforms which are not formed to present equal average and peak value.

The plate meter in an a.m. high-level modulated transmitter does not indicate any change during modulation, except for transient flickers, because it averages out to zero the symmetrical change in the current caused by the modulation process. It continues to read carrier power level although the modulator output has raised both the average and peak power output levels.

Special peak reading meters can be used across the output to indicate the actual peak output but usually an r.f. thermal type ammeter is used in the transmission line to register the increase in average power output.

Knowing the average power and the carrier power (the latter by an unmodulated c.w. test), the peak power can be found from Fig. 2. The peak and average power levels are directly related to the percentage of modulation, of course. The percentage of modulation can be calculated from the formula:

$$\text{Mod. \%} = \frac{\sqrt{P_{PEAK}} - \sqrt{P_{CARRIER}}}{\sqrt{P_{CARRIER}}}$$

In the case of an s.s.b. transmitter which is being modulated by a two-tone test signal, the plate current meter is being driven by a series of half sine waves if the final stage operates Class B so that current flows during 180 degrees of the input r.f. signal to the stage. The average value of such a wave is 0.636 of its peak value. Thus, the peak power input to the final stage is the usual plate voltage times indicated plate current reading but then divided by the 0.636 factor.

If an average reading r.f. power output meter is used on such a transmitter, its reading will also be in error. The meter in such an instrument is also driven by a series of half sine waves but the meter scale is usually calibrated on the basis of symmetrical waveform using the V^2/R relationship in watts. Thus the meter scale will be in error by a factor of 0.636^2 or 0.405. The scale reading on such an average reading wattmeter must be divided by 0.405 to obtain p.e.p. during a two-tone s.s.b. transmitter output test.

A thermal type r.f. ammeter, if it were placed in series with the transmitter output and a suitable correctly matched load, would indicate the true average current and its reading could be taken directly for an I^2R calculation of average power.

Some readers are bound to have noticed by now that the chart of Fig. 1 shows a 50 watt average power for a 100 watt p.e.p. level on s.s.b. during a two-tone test and yet it was just mentioned that the peak power input to the transmitter is found by multiplying plate voltage times plate current and then dividing by 0.636. This apparent inconsistency in the relationship between average and peak power when considering the d.c. power input and r.f. power output has caused a great deal of confusion. The confusion arises because most of us are used to thinking of the efficiency of an amplifier as a constant (60-70%, for instance). The efficiency, however, is not constant and changes during portions of the plate current flow cycle, being greatest when the current is at a maximum. This changing efficiency accounts for the small difference in the average/peak ratio between the input and output.

In the case of a keyed or pulsed transmission with essentially a rectangular waveform, the peak reading is directly related to the average value as a function of the pulse time duration, as shown in Fig. 1. The time characteristics of the waveform must be determined by means of an oscilloscope display having a calibrated time base. Actually, exactly rectangular waveforms are not usually used because of high power transmitter design difficulties with such waveforms and because of the unnecessary interference created when the pulse rate is high. With an odd shaped waveform the only real way to measure the peak or average power input is to calculate an individual correction factor for the meter readings based on an oscilloscope display and an analysis of the waveform. The thermal method remains again, however, a valid means of measuring the average power output.

PRACTICAL MEASUREMENTS

For the modulation methods commonly used today by most Amateurs, measuring the d.c. plate power input to the final stage of a transmitter is still most easily done by means of d.c. plate voltage and plate current meters. One must be sure that the correct modulation is applied to the transmitter, especially in the case of s.s.b., and the meter readings are corrected for peak value. In the s.s.b. case, the audio tones used for the two-tone test must be of exactly equal amplitude and the transmitter should be checked for linear operation.

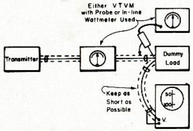


Fig. 4.—Vertical scale on oscilloscope is calibrated in watts using c.w. mode. It will then directly indicate p.e.p. during s.s.b. modulation.

The average power output of any transmitter can be measured by means of a thermal-type r.f. ammeter which is used in series with a matching dummy load for the transmitter.

Measuring peak output power levels can be done in one of several ways. If a calibrated average wattmeter is available, it can be used on s.s.b. using the 0.405 correction factor just discussed. This correction factor is only good for a two-tone test signal, however. Another method would be to operate the transmitter into a dummy load and measure the r.f. voltage across the dummy load. One has to be careful that the voltmeter used is calibrated and that it will operate properly at r.f. frequencies. If a meter is used

(Continued on Page 21)

A Semiconductor, V.H.F. Power Amplifier using a Pi-tank Circuit*

CLIFF SHARPE, G2HIF

G2HIF discusses the design of a V.H.F. P.A. using "overlay" transistors. Observations are made on several causes of unstable operation which can arise in a practical circuit, culminating in design details of a pi-tank circuit offering flexibility in load matching, and good harmonic rejection.

THE target specification of a new solid state, 144 Mc. transmitter for G2HIF/P called for a full 25 watt capability on c.w., and a maximum p.e.p. on s.s.b. consistent with easily available transistors, linearity of operation and depth of pocket.

An examination of manufacturer's literature on v.h.f. power transistors showed that the R.C.A. overlay device, 2N3632 (also by Motorola and Ferranti, or the XB402 by Texas Instruments) was rated at 13½ watts output up to 175 Mc. Two such units would easily provide a 25 watt unmodulated carrier on 2 metres and their specification also suggested that operation in the linear mode would be possible up to 10 watts mean (20 watts p.e.p.).

With the R.S.G.B. Handbook and a slide rule at the ready, a tentative circuit using a pi-tank network was postulated. The first calculations showed very forcibly that this was the wrong approach. The accepted formula yielded component values which could not be realised in practice.

As most published circuits on the data sheets favour one of the several variations of the T-network, this was a configuration which was obviously feasible. Construction of an experimental p.a. was begun. Sufficient data was readily available to enable the p.a. to be built around a single 2N3632 without knowledge of the derivation of the design parameters, and it was hoped that the workings of the finished model would help to supply some of the answers.

This preliminary venture into high power with v.h.f. semiconductors confirmed all the forebodings of other experimenters. Not only was the amplifier very non-linear, but it was also exceedingly temperamental. The thought of what might happen when two 2N3632s were connected in parallel did not bear contemplation, let alone actual construction, until more was understood of the theoretical design procedure.

A closer search was made through published articles and application reports for additional information without finding precise answers to a number of questions. In the majority of reports either the inadequacies of the approach were veiled in the ultimate setting of large variable capacitors, or else so many assumptions were made in a complex mathematical treatise that "the wood could not be seen for the trees".

The first gleam of light came when Motorola published the large signal characteristics of several power devices in graphical form. The parallel input and output impedances were shown to be functions of both power and frequency, and their values did not necessarily bear any relation to the d.c. or small signal characteristics normally quoted on data sheets.

In the accompanying report[1] a design procedure for T-network was explained which yielded realisable component values. The final step in the calculations, however, required some mathematical manipulation before the vital design formulae could be elucidated. Most Amateurs at this point would resort to "guesstimation" to derive the working capacitor values, so it was left to Malcolm Bibby, G3NJY, to thrash out the algebra and to quote working design formulae.[2]

DIFFICULTIES ARISING IN A PRACTICAL DESIGN

Experience on the Mark One was not entirely wasted effort. The idiosyncrasies of this type of p.a. were now more readily appreciated by a knowledge of the theory, and another single 2N3632 was offered for sacrifice.

The instabilities of the original design were attributed to three important factors. These were:

(a) The presentation of an incorrect load to the collector of the transistor by the matching network.

(b) A lack of understanding concerning the vital necessity of ensuring a minimal impedance between emitter and earth/chassis.

(c) A failure to take into account the possible ill effects of coupling in the supply rail through a large, high Q r.f. choke.

Although most careful designers would automatically ensure the condition required by (b) was satisfied, few Amateurs really appreciate the magnitude of the loss in power gain which can be produced by the inductance of only ½" of wire between emitter and chassis.

Inadequate decoupling in the emitter circuit can introduce more serious effects than merely a reduction of output power and in the worst cases can lead to actual instability and parasitic oscillations. The ingenuity of the designer may be severely taxed where it becomes necessary to run the stage from a positive earth supply. Many problems can be avoided—perhaps a transistor saved from self-destruction—by strapping the emitter to chassis with the shortest possible length of 1" wide copper foil (not braid).

The basic methods of obtaining the maximum transference of r.f. power from a semiconductor to a small resistive load are essentially the same as those used in valve circuits. The special problems which the transistor creates arise from the very much lower equivalent parallel input and output impedances of the device.

There is still a tendency for many Amateurs who are more at home with valve techniques to think in terms of voltages and not currents when applying themselves to semiconductors. The familiar component values of a valve tank network are a direct function of the high impedances involved. It is hardly surprising, therefore, to find that a similar network, which has been designed for a semiconductor circuit with impedances one hundredth of those found in valve circuits, require vastly different component values.

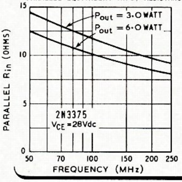
Unfortunately, these component values are often physically unattainable, especially at very high frequencies, and other networks have to be used which can make the impedance transformation with practical components. Some of the conditions in (a) arise simply through the use of wrong value components in otherwise suitable networks, but even when the designer has analysed the problem, and derived a correct matching network, he is not out of the wood.

It is inevitable that sometime during its service, the transistor will be subject to off-tune or excess load conditions, and although these may occur only during alignment, the designer cannot afford to ignore them. In high impedance circuits, there are few ill effects resulting from a badly designed tank circuit other than a lowering of the p.a. efficiency, or an increase in the valve anode dissipation. In general, detuning or excess loading will merely cause the load line to steepen, but it will continue to cut the I_A V_A characteristics over their linear region.

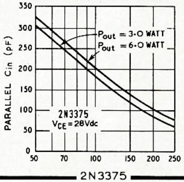
This will not be so with the semiconductor p.a. Off-tune and higher load conditions present to the transistor a greater equivalent series impedance than does the correctly tuned and loaded network. The load line will

* Reprinted from "Radio Communication," November, 1968.

PARALLEL EQUIVALENT INPUT RESISTANCE



PARALLEL EQUIVALENT INPUT CAPACITANCE



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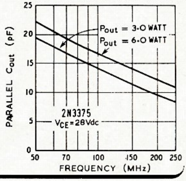

2N3375

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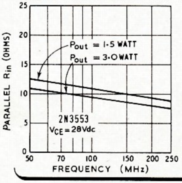

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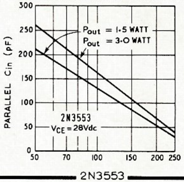

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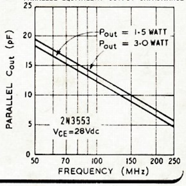

2N3553

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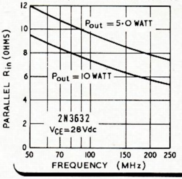

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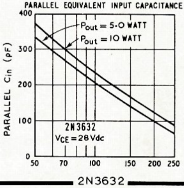

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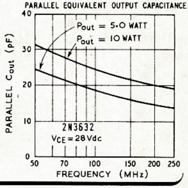
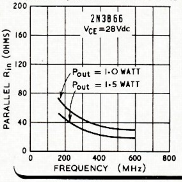


2N3632

PARALLEL EQUIVALENT INPUT RESISTANCE



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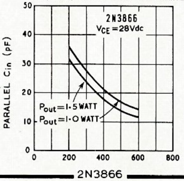

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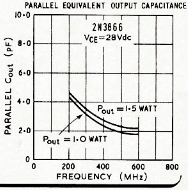


2N3866

therefore cut the I_C V_C curves below the "knee". In this region linear operation is impossible and the conditions favour parasitics and other instabilities. The desirability of choosing a tank network which minimises these adverse effects of misalignment is therefore obvious.

It is not unusual to run into difficulties in valve p.a.'s when the h.t. supply is shunt fed through an r.f. choke, but semiconductor circuits are even more prone to the ill effects a choke can produce. The need to present a high impedance to r.f. currents circulating in the tank network of a valve p.a. had educated the designer into using high Q chokes as a matter of course. The chances are, therefore, that when the need to use an r.f.c. in a solid state circuit arises he automatically specifies one which is often too good for the job.

Whereas the reactance of the choke appears in shunt with a valve tank circuit, and in consequence, tunes with the inductance of the network without shifting the resonant frequency appreciably, it appears in series with the network inductance in many semiconductor circuits.

The ill effects referred to in (c) are a direct consequence of this. If the tank is neither correctly loaded, nor tuned to resonance, the collector does not see a low impedance in shunt with the choke. The RFC thus becomes tightly coupled to the tank inductance, and will create unwanted resonances with the capacitative reactance of the tank circuit. These resonances can occur at or near the operating frequency during the alignment of the amplifier. The load which they present is usually high with the result that the collector "bottoms" and instabilities become rife.

The impedance required effectively to isolate the collector from the supply rail needs to be no greater than ten times the load presented to it by a correctly matched network. Since this load is unlikely to be more than 50 ohms, a low Q choke, or a self resonant one shunted by a 470 ohm resistance, will be adequate for the application. The unwanted resonances are thus heavily damped and are far less likely to excitation.

TEST RESULTS ON AN INTERMEDIATE DESIGN

The above precautions were scrupulously observed in the Mark Two design. More screening was introduced between the input and output circuits, and the p.a. tested into a resistive dummy load. The parameters of the T-network were aligned to deliver the rated power to the load. It was noted that the settings were in close agreement with the values calculated for the formulae derived by G3NJY. Meter indication of the collector current gave insufficient information regarding the correct tuning, but once the settings had been established, they could be repeated by observation of the load current. Good linearity was maintained to power levels approaching 70 per cent. of those obtained with an unmodulated carrier.

On-the-air tests proved encouraging. A modulated envelope from a QRP valve transmitter provided the modest drive requirements to the 2N3632 and several QSOs were held at a mean power level of 4½ to 5 watts output. Speech quality reports confirmed the amplifier to be linear. More exhaustive tests with Colin Desborough, G3NNG, however, revealed the third harmonic content to be above that which could be tolerated. Strength S3 to S4 over a nine-mile path, and impossible for common site working on v.h.f. N.F.D.

THE FINAL PI-CIRCUIT

The quest for a more efficient tank network which would filter off a greater proportion of the 432 Mc. harmonic brought the considerations of the design back to square one. The pi-tank has not achieved almost universal popularity in valve p.a.'s without good reason. The question was, could any circuit configuration using a 2N3632 be made to work which would exploit the flexibility and performance capabilities of the network?

The figures were re-examined. Impedance transformation from a few K ohms to a typical cable Z_0 are well within the efficient range of a pi-network, and a few minutes with a slide rule will confirm that these numbers result in realistic component values on 144 Mc. It follows then, that the transformation from 50 ohms to a few K ohms is equally possible. Since two networks may be connected in tandem provided the output impedance of the first equals the input impedance of the second, here was a possible solution to the problem of gaining better harmonic rejection with a more flexible network.

Although the collector of a 10 or 20 watt p.a. is more likely to see a load of considerably less than 50 ohms, the prospect still seemed a good proposition when the possible variations of the network Q were taken into account.

Two pi-networks in tandem; a minimum of three variable capacitors. The tuning procedure for correct alignment was formidable. However, if an L network could be designed to replace the first pi, the design of the new network was home and dry. It remained only to work out the component values in the practical case.

RESULTS

The final p.a. design and pi-tank network proved very simple to get working, and on-the-air tests confirmed that the harmonic radiation on 432 Mc. was reduced to the limits which would be imposed by common site working on v.h.f. N.F.D.

The tuning procedure followed closely that of a normal pi-tank, but the adjustments should always be made for a maximum r.f. current in the load rather than by observation of collector current. A check on this current, however, is valuable in providing an indication of the collector dissipation and input drive requirements.

Two circuits, one using a single 2N3632 running at 13½ watts c.w., and one which connected two similar devices in parallel to give 20 watts p.e.p. were constructed, and neither showed any signs of instability during alignment or operation. The linearity of the latter amplifier was judged to be more than adequate for s.s.b. through its ability to handle a 100 per cent. amplitude modulated carrier without distortion.

The drive requirements of each of the 2N3632s when wired in parallel were well matched in the samples tested, but it is recommended that a method of equalising the drive to each in order to balance the outputs be incorporated in the design. Care should always be exercised to ensure the amplifier is not over-driven, especially when optimum linearity is required.

CONSTRUCTIONAL NOTE

Both models were constructed on a copper earth plain mounted in the lid of a 4½" v 3½" die-cast box. No additional heat sink was necessary.

The two inductances in the tank network were not mutually coupled, and if mounted at right angles interact insufficiently to disturb the correct operation.

Whilst careful layout could obviate the necessity to fit screening between the base and collector circuits, a screen across the collector terminals proved advantageous in maintaining absolute stability during alignment.

Details of the input networks to the transistor bases are not discussed in this report as further experimental work on optimising the design of this section of the amplifier is still being carried out.

REFERENCES

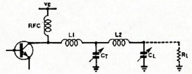
1—"Systemising R.F. Power Amplifier Design." Motorola Application Report No. 282.

2—"The Design of T Networks for Series Tuned, Semiconductor Power Amplifiers," Malcolm Bibby, G3NJY. "QAV" Tech. Supplement, A.E.R.E. Radio Club Newsletter, May-June, 1967. Also "Radio Communication," February 1968, page 96.

3—"Technical Topics," R.S.G.B. "Bulletin," May 1967.

APPENDIX

THE NETWORK



C_T Main tuning capacitor.
C_L Loading capacitor.
L1 L-network inductance.
L2 Pi-network inductance.
R_L Transmitter load resistance.
V_C Supply voltage.

THE DESIGN METHOD

The first part of the design procedure determines the L section of the network in Fig. 1. It follows closely the method set out by Malcolm Bibby, G3NJY, for T networks in series tuned semiconductor power amplifiers.

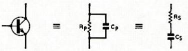


Fig. 1.

The two parameters which must be determined initially are the large signal output capacitance of the transistor, and its equivalent parallel resistance.

The output capacitance, C_P, is obtained from the manufacturer's data sheet of the transistor, and will be quoted in the form of capacitance/frequency graphs at various power levels. The output resistance, R_P, will not be included in the data sheet because it can be computed with sufficient accuracy by assuming a peak-to-peak r.f. voltage swing of twice the supply voltage, V_C.

If P is the mean power output, the equivalent parallel resistance of the transistor,

$$R_P = \frac{V_C^2}{2P}$$

The parallel resistance and capacitance must now be converted mathematically to the equivalent series circuit; Fig. 2. The equivalent series resistance,

$$R_S = \frac{R_P \cdot X_P}{R_P^2 + X_P^2} \cdot X_P$$

and the equivalent series capacitive reactance,

$$X_S = \frac{R_P \cdot X_P}{R_P^2 + X_P^2} \cdot R_P$$

where $X_P = \frac{1}{\omega C_P}$

and $X_S = \frac{1}{\omega C_S}$

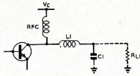


Fig. 2.

The series impedance of the device, Z_S, is therefore equal to $R_S - jX_S$. For the maximum power transfer to a load, the load impedance must be the conjugate of the source impedance, or $R_S + jX_S$; Fig. 3. It is desirable that the network should provide harmonic rejection and ease of tuning, therefore a working Q of between 8 and 20 should be chosen as being satisfactory at v.h.f.

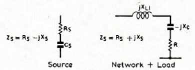


Fig. 3.

Since X_{L1} and X_{C1} (Fig. 3) may have a range of values, the desired loaded Q of the network may be obtained by a choice of the inductance, L1. The formula relating the inductive reactance, X_L, the series resistance, r, and Q is

$$Q = \frac{X_L}{r}$$

so that here $X_{L1} = Q\ R_S$.

The impedance of the source plus the inductive reactance, X_{L1}, is $R_S + j(X_{L1} - X_S)$, thus the impedance of $R - jX_D$ must be the conjugate to establish the match. From this, by equating the real and imaginary parts,

$$R = R_S$$

and $$X_C = (X_{L1} - X_S)$$

The values of C1 and R_{L1} in the L network (Fig. 1) may now be calculated by making the series to parallel conversion.

Thus $$R_{L1} = \frac{X_C^2 + R_S^2}{R_S}$$

and $$X_{C1} = \frac{X_C^2 + R_S^2}{X_C}$$

$$C_1 = \frac{1}{\omega X_{C1}}$$

It remains only to apply the Pi-network formula (see R.S.G.B. Handbook) to complete the design of the tank circuit; Fig. 4. This formula states,

$$X_{C2} = \frac{R_1}{Q}\left[1 + \sqrt{\frac{R_2}{R_1}}\right]$$

$$X_{C3} = X_{C2}\sqrt{\frac{R_2}{R_1}}$$

$$X_{L2} = \frac{R_1}{Q}\left[1 + \sqrt{\frac{R_2}{R_1}}\right]^2$$

$$C_2 = \frac{1}{\omega X_{C2}}$$

$$C_3 = \frac{1}{\omega X_{C3}}$$

$$L_2 = \frac{X_2}{\omega}$$

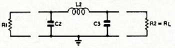


Fig. 4.

Thus the values of the capacitive reactance, X_{C2} and X_{C3}, and the inductive reactance, X_{L2}, may be obtained by making $R_1 = R_{L1}$, and $R_2 =$ the transmitter load, R_L.

The two sections of the tank are connected together by lumping C_1 and C_2 in parallel to form the tuning capacitor, C_T. C_3 is the loading capacitor, C_L.

The Q chosen for the Pi section need not be the same value as that chosen for the L section. Improved harmonic rejection will be obtained with the higher values of Q.

WORKED EXAMPLES

Network design for a single 2N3632 transistor operating at 13½ watts c.w. output into a 72 ohm resistive load. Frequency = 144 Mc. Supply voltage = 28 volts.

From data sheet, parallel equivalent output capacity, C_P, at stated power and frequency.

$C_P = 22$ pF.

Parallel equivalent output resistance, R_P, at stated power,

$$R_P = \frac{V_C^2}{2P}$$
$$= \frac{28^2}{2 \times 13\frac{1}{2}}$$
$$= 29 \text{ ohms.}$$

Reactance of $C_P = \frac{1}{2\pi f C_P}$

$f = 144$ Mc.
$2\pi f = 9.1\ 10^8$

Thus $$X_P = \frac{10^{12}}{9.1 \times 10^8 \times 22}$$
$$= 50 \text{ ohms.}$$

By the parallel to series conversion,

$$R_S = \frac{29 \times 50}{29^2 + 50^2} \times 50$$
$$= 0.436 \times 50$$
$$= 22 \text{ ohms}$$

and similarly

$$X_S = \frac{29 \times 50}{29^2 + 50^2} \times 29$$
$$= 0.436 \times 29$$
$$= 12.7 \text{ ohms.}$$

For a Q of 10, reactance of L1

$X_{L1} = Q\ R_S$
$= 10 \times 22$
$= 220$ ohms

and L1 $= 0.24\ \mu$H.

From $X_C = (X_{L1} - X_S)$
$X_C = (220 - 12.7)$
$= 207.3$ ohms.

To obtain the values of C1 and R_{L1} of Fig. 1, the series combination of X_C and R_S must be converted to the parallel equivalent.

Thus from the formulae,

$$X_{C1} = \frac{2.07^2 \times 10^4 + 2.2^2 \times 10^2}{2.07 \times 10^2}$$
$$= 208 \text{ ohms.}$$

From which

$$C1 = \frac{10^{12}}{9.1\ 10^8 \times 208}$$
$$= 5.3 \text{ pF.}$$

and similarly

$$R_{L1} = \frac{2.07^2 \times 10^4 + 2.2^2 \times 10^2}{2.2 \times 10}$$
$$= 1.97\text{K ohms.}$$

So the L section has been determined. Substituting in the pi-network formula, R1 = 1.97 10^3 and R2 = 72 for a selected Q of 15

$$X_{C2} = \frac{1.97 \times 10^3}{15}\left[1 + \sqrt{\frac{72}{1.97 \times 10^3}}\right]$$
$$= 156 \text{ ohms.}$$

Therefore $$C2 = \frac{10^{12}}{9.1 \times 10^8 \times 156}$$
$$= 7.1 \text{ pF.}$$

$$X_{C3} = 156\sqrt{\frac{72}{1.97 \times 10^3}}$$
$$= 29.7 \text{ ohms.}$$

So C3 $= 37.0$ pF.

SEMICONDUCTOR

$$X_{L2} = \frac{1.97 \times 10^3}{15}\left[1 + \sqrt{\frac{72}{1.97 \times 10^3}}\right]^2$$
$$= 186 \text{ ohms}$$

and L2 $= 0.204\ \mu$H.

(Continued on Page 24)

Geelong Radio and Electronics Society's New Club Rooms

Over 200 people were present to see Mr. Reynolds cut the ribbon which formally opened the Society's new club rooms on the Belmont Common.

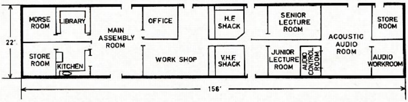
Bill Erwin (VK3WE), President, and Harry Michael (VK3ASI), Secretary, welcomed all visitors. The official guests besides Mr. Reynolds, who was President of South Barwon Shire Council, in whose Shire the Belmont Common lies, were Cr. Wood (Mayor of Geelong), Michael Owen (VK3KI), Federal President W.I.A., and Keith Roget (VK3YQ), Divisional President.

Bill was able to point with pride to the success the Society had had within the six years of its existence. They had been fortunate to have been able to lease on very generous terms, a disused migrant hostel. Its condition had deteriorated to such an extent that all services, water and electricity were condemned. Without outside aid they have removed walls, put in trusses, rewired electric outlets, connected water, repaired plumbing and used twenty-five gallons of paint. In addition, $1,200 has been raised and spent on the project. The diagram shows the layout that they have been able to achieve.

The Club station, VK3ANR, very ably handled the VK3 Divisional call back after the broadcast on Sunday morning. This station will be pleased to have QSOs any time they are on the air. Visitors are welcome to the Society, which also caters for hi-fi and other electronic equipment interests.

The Belmont Common is ¾ mile along the left hand side of the Barwon Heads road after crossing the Barwon River at the Princes Highway.

GEELONG RADIO & ELECTRONICS SOCIETY CLUB ROOMS.



PLEASE QSL OM . . .

Who can deny the pleasure of receiving one's very first QSL card, the one which completes the score for DXCC, or the one from that elusive ZZ call area?

However, courtesy requires that cards be exchanged, and this is where the new Amateur strikes a problem. Funds are probably low when first going on the air, and printing takes time.

This is how I solved the problem, and was able to despatch cards within a few days of receiving my call sign and getting on the air.

First I bought eight sheets of thin white card from the local printer, capable of being cut into six foolscap pieces each. Each piece accommodates four QSL cards—result, 192 cards for about $1.00.

The front of the card has the call sign in large letters, with name above, and QTH below—in free lettering, designed by harmonic No. 1. The back has the usual information, plus room for address to and postal address from. A line drawing of a man separates the information from the addresses. He was designed by harmonic No. 2.

The designs were traced onto two spirit duplicator sheets and the cards run through the machine twice. The foolscap sheets were cut into four, and coloured using felt pencils—two contrasting colours on the front, and a third for the man at the back.

The colouring is rather tedious, and for a start the whole family joined in, to give me a start. I now do a few at a time, often while listening on the band.

If there are no artistic members in the family, perhaps an art student at the local school could help. There is also a firm which designs cards, and advertises in "A.R."

Duplicated cards such as these will assist in trying out designs and wording, and will enable the new Amateur to get started at the earliest possible time, until his cards can be printed. So, you newcomers, reach for a 4H pencil, and get cracking!

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MEASURING POWER INPUT

(Continued from Page 16)

which is so-called peak reading but has a scale calibrated in r.m.s. values, the values read from the scale can be used directly in the V^2/R formula to calculate the peak power.

Another method that avoids some of the instrument problems of the last method is to use a calibrated oscilloscope display (Fig. 4). Use c.w. transmissions first and find the power output either by an average reading wattmeter (which for c.w. requires no scale correction) or by measuring the voltage across a dummy load with a v.t.v.m. and r.f. probe (following the v.t.v.m. instructions to determine the a.c. r.m.s. voltage values) and simply using the V^2/R formula. The oscilloscope scale is marked for various power levels. The transmitter is then switched to s.s.b. transmission and the vertical scale deflection on the oscilloscope will give a direct and instantaneous indication of the p.e.p. output level under tone or voice modulated conditions. The same scheme can be used to check the peak output level using any other modulation method as well.

OBITUARY

GEORGE R. McCULLOCH, VK3GM

George R. McCulloch, Ass.I.R.E., passed away on 6th May, 1969, at the age of 62 years.

George was first licensed in 1926 and held the call sign of A3GM. He was a genuine experimental radio operator and conducted a lot of work on the 200 metre band in the early part. Later, with re-issue of the licence VK3GM, he worked on the higher frequency bands, particularly 10, 5 and the 2 metre bands where he won the Ross A. Hull Memorial V.h.f. Contest in 1955-56. Most of George's equipment was home-built and was still in working order at his death.

George will be missed by his many friends and Radio Amateur operators.

The Institute and all Amateurs extend their deepest sympathy to his wife and family.

Technical Correspondence

FET GATE DIP OSCILLATOR

Editor, Dear Sir,

Gadget builders will be disappointed with the performance of the FET Gate Dip Oscillator described in the journal for June 1969 (p. 14). With the circuit as it stands, there is an intolerable drop-off of oscillator output at the high frequency end of each range.

This defect is cured by increasing the source by-pass capacitor, which is shown as being an improbably low 10 pF. in the circuit diagram. When this is replaced by a 0.047 uF. capacitor the g.d.o. performs well, although some adjustment of the voltage applied to the base of the d.c. amplifier may be necessary for some transistors, e.g. a 10K resistor from base to ground.

—Robert H. Black, VK2QZ.

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CONTEST CALENDAR

16th/17th August: W.I.A. R.D. Contest.
30th/31st August: 10th "AA" DX Contest—J.A.R.L. (c.w. only).
4th/5th October: VK-ZL-Oceania DX Contest, 1969 (phone section).
4th/12th October: Lebanese DX Contest.
11th/12th October: VK-ZL-Oceania DX Contest, 1969 (c.w. section).
11th/12th October: R.S.G.B. 28 Mc. Telephony Contest.
25th/26th October: "CQ" W.W. DX Contest—phone section.
9th November: International OK DX Contest (c.w. only).
6th Dec. to 11th Jan., 1970—Ross A. Hull V.h.f. Memorial Contest.
1st/2nd February, 1970: John Moyle National Field Day.

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ERRATUM

The author of "A Field-Day Transmitter," "A.R." May 1969, has pointed out an error in the circuit diagram. If wired as shown, and the function switch set to the "Tx Ph." condition, the diode OA210 would be reverse biased and the receiver mute relay would not operate.

Readers are asked to correct the diagram by removing the connection from "TSA4-6" (receiver mute relay) to the OA210 and replacing it on the other side of the OA210, i.e. the junction of the OA210 and T/R relay.

VK-ZL-OCEANIA DX CONTEST, 1969

N.Z.A.R.T. and W.I.A., the National Amateur Radio Associations in New Zealand and Australia, invite world-wide participation in this year's VK-ZL-Oceania DX Contest which is one function of New Zealand's Bi-Centennial Celebrations.

Objects: For the world to contact VK-ZL-Oceania Stations and vice versa.

When? Phone: 24 hours from 1000 GMT, Saturday, 4th October, to 1000 GMT, Sunday, 5th October.

C.w.: 24 hours from 1000 GMT, Saturday, 11th October, to 1000 GMT, Sunday, 12th October.

RULES

1. There shall be three main sections to the Contest:—
   (a) Transmitting phone.
   (b) Transmitting c.w.
   (c) Receiving—phone and c.w. combined.

2. The Contest is open to all licensed transmitting stations in any part of the world. No prior entry need be made. Mobile marine and other non-land based stations **are permitted** to enter. Their "country status" will be determined by the country which issued the call sign used in the Contest.

3. All Amateur frequency bands may be used but no crossband operation is permitted. **Note**: VK and ZL stations irrespective of their location do **not** contact each other for contest purposes, **except on 80 metres**, on which band contacts between VK and ZL stations are encouraged.

4. Phone will be used during the first week-end and c.w. during the second week-end. Stations entering both sections must submit separate logs.

5. Only one contact on c.w. and one contact on phone per band is permit-tetd with any one station for scoring purposes.

6. Only one licensed Amateur is permitted to operate any one station under the owner's call sign. Should two or more operate any particular station, each will be considered a competitor and must submit a separate log under his own call sign. This is not applicable to overseas' competitors operating Club stations.

7. Entrants must operate within the terms of their licence.

8. **Cyphers**: Before points can be claimed for a contact, serial numbers must be exchanged and **acknowledged.** The serial number of five or six figures will be made up of the RS (phone) or RST (c.w.) report plus three figures which may begin with any number between 001 and 100 for the first contact and which will increase in value by one for each successive contact. Example: If the number chosen for the first contact is 021, then the second must be 022 followed by 023, 024, etc. After reaching 999, restart from 001.

9. **Scoring:**

(a) **For Oceania Stations other than VK/ZL**: 2 points for each contact on a specific band with VK-ZL stations; and 1 point for each contact on a specific band with the rest of the world.

(b) **For the Rest of the World other than VK-ZL**: 2 points for each contact on a specific band with VK-ZL stations; and 1 point for each contact on a specific band with Oceania stations other than VK-ZL.

(c) **For VK-ZL Stations**: 5 points for each contact on a specific band and, in addition, for each new country worked on that band **bonus** points on the following scale will be added:

1st contact	....	50 points
2nd ,,	....	40 ,,
3rd ,,	....	30 ,,
4th ,,	....	20 ,,
5th ,,	....	10 ,,

Note: The A.R.R.L. countries list will be used except that each **call area** of "W/K", "JA", "UA" will count as "countries" for scoring purposes as indicated above.

For 80 metre contacts between VK and ZL stations, each VK and ZL call area will be considered a "scoring area" with contact points and bonus points to be counted as for DX contacts. **Note:** Contacts between VK and ZL on **80 metres only.**

10. **Logs:**

(A) **Overseas Stations—**

(a) Logs to show in this order: date, time in GMT, call sign of station contacted, band, serial number sent, serial number received, points claimed. **Underline** each new VK-ZL call area contacted. Separate log must be submitted for each band used.

(b) **Summary Sheet** to show call sign, name and address in BLOCK LETTERS, details of station, and, for **each band:** QSO points for that band, VK-ZL call areas worked on that band. "All Band" score will be total QSO points multiplied by sum of VK-ZL call areas on all bands, while "single band" scores will be that band QSO points multiplied by VK-ZL call areas worked on that band.

(B) **VK-ZL Stations—**

(a) Logs must show in this order: date, time in GMT, call sign of station worked, band, serial number sent, serial number received, contact points, bonus points. **Use separate log for each band.**

(b) **Summary Sheet** to show: name and address in BLOCK LETTERS, call sign, score for each band by adding contact and bonus points for that band, and "all band" score by adding the band scores together; details of station and power used; declaration that all rules and regulations have been observed.

11. The right is reserved to disqualify any entrant who, during the Contest, has not strictly observed regulations or who has consistently departed from the accepted code of operating ethics.

12. The ruling of the Executive Council of the N.Z.A.R.T. will be final.

13. **Awards:**

World-wide except VK-ZL—

(a) Attractive multi-colour certificates to the top scorers in each country (call area in "W", "JA" "UA"). Separate awards for phone and c.w.

(b) Similar certificates to all participants with a minimum operating time.

(c) **Silver Shield and N.Z.A.R.T. Badge** mounted on polished wooden base awarded in the following categories:
   (1) Top scorer in each continent with separate awards for phone and c.w.
   (2) Top world score on each band: 40, 20, 15, 10. Separate awards for phone and c.w.
   (3) Top "club" entry from North America and from Europe to consist of a phone log and a c.w. log from members of that club—e.g. Ohio Valley DX Club, West Gulf DX Club, Long Island DX Association, etc., etc.
   (4) Multi-operator "club" stations in U.S.S.R. using c.w. only.

Note.—Stations entering for the "club" award must clearly indicate name of club and also entry for this section of the contest.

(d) **S.w.l.**: Attractive multi-colour certificates as for transmitting section in (a) above.

(e) Copper Medallions specially struck for New Zealand's Bi-Centennary awarded to the following:
   (1) Each winner in category (c) above.
   (2) Runner-up in each section of category (c).

VK-ZL Awards—

(a) Attractive multi-colour certificates to the following:
   (1) To the top three scorers in each call area of VK and of ZL.
   (2) To the top three scorers on individual bands (80, 40, 20, 15, 10) in VK and in ZL. Separate awards for phone and for c.w.

(b) Similar certificates to participants with a "minimum" operating time.

(c) Large silver mounted plaque to the top scorer in both VK and in ZL with separate awards for phone and for c.w.

(d) Silver mounted shield to runner-up in section (c) above.

(e) Silver mounted shield to top VK and top ZL scorer using 80 metres **only.** Separate awards for phone and for c.w.

(f) Silver mounted shield to top scoring ZL on 40, 20, 15, 10 with separate awards for phone and for c.w.

(g) Copper Medallions specially struck for New Zealand's Bi-Centenary awarded to the following:
   (1) Each winner in sections c, d, and e above.
   (2) Top scorer in each call area of VK and ZL, both on phone and on c.w.

(3) Top scorer on each individual band for VK and for ZL. Separate medallions for phone and for c.w.

Except that duplicate medallions will not be awarded where one entrant is the top scorer in more than one section.

(h) One year's subscription to N.Z.-A.R.T. publication "Break-In" to top scoring VK station on phone and on c.w.

(i) **S.w.l.**: Multi-colour certificates to the top scoring S.w.l. in each VK-ZL call area with medallion to the top scorer for VK and ZL.

14. **Entries** from—

VK-ZL should be posted direct to—

N.Z.A.R.T. Contest Mgr., ZL2GX,
152 Lytton Rd., Gisborne, N.Z.,

to arrive not later than 31st December, 1969.

Overseas Stations to the above address **or**—

N.Z.A.R.T.,
P.O. Box 489, Wellington, N.Z.,

to arrive not later than 23rd January, 1970.

S.W.L. SECTION

1. The rules are the same as for the transmitting section but it is open to all members of any S.w.l. Society in the world. No transmitting station is permitted to enter the contest.

2. The contest times and logging of stations on each band per week-end are as for the transmitting section except that the same station may be logged twice on any one band—**once on phone** and **once on c.w.**

3. To count for points, the station heard must be in QSO exchanging cyphers in the VK-ZL-Oceania DX Contest and the following details noted: date, time in GMT, call of the station heard, call of the station he is working, RS(T) of the station heard, serial number **sent** by the station heard, band, points claimed.

4. Scoring is on the same basis as for the transmitting section and a **summary sheet** should be similarly set out.

5. Overseas stations may log **only VK-ZL** stations, but VK receiving stations may log overseas stations and ZL stations, while ZL receiving stations may log overseas stations and VK stations.

5. Awards will be made as listed in the section under "Awards".

SPECIAL NOTE

1. There are several changes in the rules for this year's contest. These have been made in an endeavour to increase activity and to cater for the large number of ZLs who operate on 80 metres only. 80 metre QSOs are encouraged between VK and ZL. Activity from mobile marine stations is encouraged.

2. There are a large number of awards available both for VK-ZL stations as well as for overseas stations.

3. This contest is part of New Zealand's Bi-Centennial Celebrations.

4. The success of any function depends on **publicity**. All VK and ZL stations are requested to give this year's contest—specially geared for New Zealand's Bi-Centennial—all the publicity possible.

5. Advance publicity has already gone out to major Societies and DX clubs.

6. A condensed version of these rules is being sent to all winners in the 1968 contest; to Amateur Radio Societies around the world, to DX clubs, to Amateur Radio magazines, and to DXers in general!

7. Do you know any member of an overseas DX club very well? Draw his attention to the trophy for competition among DX clubs. A challenge might help!

—Jock White, ZL2GX,
Contest and Awards Manager, N.Z.A.R.T.

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NEW CALL SIGNS

APRIL 1969

VK1BX—M. C. Hooper, Flat 36, Block C, Kanangra Crt., Reid, 2601.
VK2FZ—A. Pollock, 15 Matthew Pde., Blaxland, 2774.
VK2ASF—S. C. Fletcher, Maling St., Eden, 2551.
VK2BWT—W. M. Thompson, 3 Kalbada Ave., Gymea Bay, 2227.
VK3MU—R. G. O. Wilson, 45 Pleasant Rd., East Hawthorn, 3123.
VK3AQM—P. R. Seddon, 3 Cobden St., Ballarat, 3350.
VK3AUJ—J. H. Hutchinson, 37 Bruce St., Mitcham, 3132.
VK3AXV—S. R. Goodwin, Station: Kaniva; Postal: P.O. Box 81, Kaniva, 3419.
VK3AZZ—R. J. Gray, Flat 2, 11 George St., Reservoir, 3073.
VK4EV—R. A. Everingham, 30 Hunter St., Everton Park, 4053.
VK4IQ—C. J. Case, 6 Granville St., Pimlico, Townsville, 4810.
VK4IT—P.M.G. Technicians' School Radio Club, 28 Banfield St., Chermside, 4032.
VK4QL—M. S. Pedder, 24 McNamara St., Toowoomba, 4350.
VK4ZIR—I. R. Milne, Listening Ridge, Pechey, Crows Nest, 4355.
VK4ZTK—R. C. Tulloch, 40 Sussex St., Hyde Park, Hermit Park, 4812.
VK5AV—J. B. Masters, 4 Calum Gr., Seacombe Heights, 5047.
VK5HJ—H. J. Town, C/o. Superintendent, Radio Branch, 31 Franklin St., Adelaide, 5000.
VK5IR—G. R. Thompson, 15 Fleetwood Cres., Henley Beach, 5022.
VK5PB—R. G. Stone, 120 Coombe Rd., Allenby Gardens, 5009.
VK5ZWI—Wireless Institute of Australia (S.A. Division) V.h.f. Group, Station: Mobile; Postal: C/o. J. A. Hackworth, 34 Oaklands Rd., Somerton Park, 5044.
VK5ZWS—J. B. Sparrow, 62 Portland Rd., Queenstown, 5014.
VK6BV—B. E. C. Varley, 79 Stubbs Tce., Daglish, 6008.
VK6ED—E. F. Davies, 104 Kent St., Busselton, 6280.
VK6IA—I. G. Dawson (Rev. Fr.), Franciscan Friary, 53 Grt. Northern H'way, Midlands, 6056.
VK6JY—J. M. Young, 61 Peoples Ave., Gooseberry Hill, 6076.
VK6MR—M. P. Ryan, 12 Warrick Rd., Sorrento, 6020.
VK6VN—V. Mathews, Lot 169, Mereworth Rd., Thornlie, 6108.
VK6WD—W. G. Dowie, 19 Sadlier St., Subiaco, 6008.
VK6ZDB—G. S. Byass, 10 Florence Rd., Nedlands, 6009.
VK6ZFQ—K. C. Thompson, 52 Minninup Rd., Bunbury, 6230.
VK6ZLM—L. K. McPherson, Station: Carnarvon; Postal: C/o. P.O. Carnarvon, 6701.
VK7CD—C. A. Danforth, Lockett St., Wynyard, 7325.
VK7NB—N. Bolland, 4 St. Georges Tce., Battery Point, 7000.
VK7ZDW—D. R. Wilson, Junee Rd., Maydena, 7457.
VK7ZMS—M. G. Salier, 6 Osborne St., Sandy Bay, 7005.
VK7ZJR—B. Robinson, 5 Nevin St., South Hobart, 7000.
VK8ZGY/T—G. L. Tillett, Flat 1, 6 Hong St., Alice Springs, 5750.
VK9GD—A. G. Dunn, Station: Kapuna, P.; Postal: United Church, Kapuna, P.M.B., Boroko, P.
VK9LB—J. R. Liebgold, Station: **Norfolk Island**; Postal: C/o. Barry Research, Box 287, Norfolk Island.

CANCELLATIONS

VK2FE—E. F. Davies. Now VK6ED.
VK2ANI—A. H. Nicholls. Transferred to Qld.
VK2BJD/T—B. J. Dwyer. Not renewed.
VK2ZCS—A. Pollock. Now VK2FZ.
VK3AOK—A. D. Swinton. Now VK2BBJ.
VK3AXO—R. G. O. Wilson. Now VK3MU.
VK3AYP—W. H. Preston. Not renewed.
VK3ZUN—B. S. W. Churchill. Transferred to A.C.T.
VK3ZWA—G. S. Byass. Now VK6ZDB.
VK3ZYG—S. R. Goodwin. Now VK3AXV.
VK3ZZS—P. R. Seddon. Now VK3AQM.
VK4DK—J. A. Kelly (Dr.). Deceased.
VK4LH—L. Grimshaw. Now VK2BLG.
VK4ZRE—R. A. Everingham. Now VK4EV.
VK5DR—R. C. G. Jackson. Transferred to Vic.
VK5KW—C. J. Kosina. Not renewed.
VK5OL—R. E. Maricle. Transferred to Vic.
VK5SB—I. S. Brown. Not renewed.
VK5WB—F. W. Blake. Not renewed.
VK5ZGY/T—G. L. Tillett. Now VK8ZGY/T.
VK5ZKV—W. Blackburn. Not renewed.
VK5ZXL—K. D. Roper. Not renewed.
VK6GG—H. E. Rhodes. Deceased.
VK6RY—R. Chamberlain. Now VK7RV.
VK6VG—J. V. Griffin (Bro.). Transferred to Vic.
VK6ZBV—B. E. C. Varley. Now VK6BV.
VK6ZBY—J. M. Young. Now VK6JY.
VK6ZCW—M. P. Ryan. Now VK6MR.
VK6ZDD—W. G. Dowie. Now VK6WD.
VK6ZEU—V. Mathews. Now VK6VN.
VK7ZCD—C. A. Danforth. Now VK7CD.
VK8AV—J. B. Masters. Now VK5AV.
VK9LM—L. Meek. Not renewed.
VK9LR—R. H. Leskie. Not renewed.
VK9ZJK—J. Kendall. Not renewed.

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SOLID STATE TRANSCEIVER

(Continued from Page 9)

interested should write direct to the makers at the address given.

FOOTNOTE

It may be worth mentioning a few component value changes and additions that have been found necessary.

(i) The values of C5 and C6 for the 20 metre front ends have been increased from 100 pF. to 220 pF.
(ii) The value of C1 on the 160 metre tx mixer has been reduced from 33 pF. to 22 pF.
(iii) The value of C1 on the 40 metre tx mixer has been reduced from 22 pF. to 15 pF.
(iv) An 0.01/25 volt ceramic disc condenser has been added across the 1.5K noise limiter trimpot on the i.f. board.
(v) An 0.01/25v. ceramic disc between the drain of the 3N140 and earth on the tx audio board.
(vi) An 0.1/25v. ceramic disc between pin 9 of the uA719C integrated circuit and earth on the i.f. board.

It is hoped that next month a suitable power supply will be described.

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VOLUNTEERS WANTED

The Publications Committee is in need of assistance. Our immediate needs are for extra draftsmen. Whilst it is preferable that our draftsmen be located in Melbourne, this is not strictly necessary. If you can help, please contact the Assistant Editor, Ed Manifold, VK3EM, 267 Jasper Road, McKinnon, Vic., 3204 (phone 58-7745), or the Administrative Secretary of the Victorian Division.

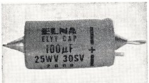
New Equipment

100 mW. TRANSCEIVER

Available from Melbourne's wholesale house, Radio Parts Pty. Ltd., is the Pony brand model CB-16, 100 mW. Transceiver. Completely transistorised, the unit operates on 27.24 Mc., and is crystal controlled. Superheterodyne, crystal controlled receiver; selectivity 10 Kc. at 18 db. down. The unit uses 10 transistors, 1 diode, 1 thermistor, and two crystals; aerial extends to 4 ft., overall weight 1.02 lb.

Trade price per pair: $62.50 plus 15% sales tax. A technical leaflet is available from Radio Parts Pty. Ltd., 562 Spencer St., Melbourne, or their city depot and East Malvern branch.

ELNA CAPACITORS



A range of electrolytic capacitors branded ELNA is now available throughout Australia. There are types for a variety of applications including miniature, pigtail, printed circuit, twist-lug can, and standard can.

All types are hermetically sealed with a high quality production finish; other features offered by the manufacturer are low leakage, welded connections, high ripple ratings, and extended shelf life combined with robust and compact construction.

A technical brochure is available on application to the Australian agents: Soanar Electronics Pty. Ltd., 45 Lexton Road, Box Hill, Vic., 3128.

EDDYSTONE EA12 RECEIVER

The Eddystone EA12 Communications Receiver is designed specifically for Amateur use, catering for a.m., c.w. and s.s.b. signals.

Frequency coverage.—Range 1: 29.4-30 Mc.; Range 2: 28.9-29.5 Mc.; Range 3: 28.4-29.0 Mc.; Range 4: 27.9-28.5 Mc.; Range 5: 20.9-21.5 Mc.; Range 6: 13.9-14.5 Mc.; Range 7: 6.9-7.5 Mc.; Range 8: 3.4-4.0 Mc.; Range 9: 1.8-2.4 Mc.

The double conversion circuit uses a total of thirteen valves and five silicon diodes, two of the latter being power rectifiers. The overall bandwidth at 6 db. down is continuously variable within the limits 1.3 Kc. to 6 kc. and is narrowed to 50 c/s. when using the 100 kc. crystal filter.

Further information from: R. H. Cunningham Pty. Ltd., 608 Collins Street, Melbourne, Vic., 3000.

LIGHT-WEIGHT HEADPHONES

Designed specifically to eliminate the heavy "closed-in" feeling when wearing conventional headphones, a completely new approach to high-fidelity listening is now available with the Sennheiser "Open-aire", HD-414 headphone set.

Feather-light, foam ear cushions do away with air-tight pressure upon the ears to give absolute comfort for the user. Fidelity reproduction is possible from 20 to 20,000 c/s., and high or low impedance output connections can be made. The headset is of simple, rugged modular design and construction, all major parts including the high-impact plastic headband, earpieces, dynamic elements and cords are easily replaceable as separate units, without the need for any special tools. A 10 ft. cord and stereo plug is provided; weight 5 oz. (without cord).

Price: $14 plus sales tax where applicable.

Further information from R. H. Cunningham Pty. Ltd., 608 Collins Street, Melbourne, Vic., 3000.

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New Circulation Policy

The Victorian Division, Wireless Institute of Australia, as publishers of "Amateur Radio," has given considerable consideration to the policy to be adopted regarding the circulation of the magazine.

For a number of reasons, both financial and constitutional, it has been decided that as from September, "Amateur Radio" will not be available from booksellers, nor by direct subscription to residents of Australia or its Territories.

Direct subscriptions will be accepted only from Federal or State Government Departments, Educational institutions, and Public Libraries—both government and municipal.

In all other cases, it will be necessary for readers to join the Wireless Institute of Australia in the appropriate grade of membership to ensure receiving continuity of the magazine. All existing subscriptions will be fulfilled.

In the case of overseas subscribers, whether direct or through an affiliated society of the I.A.R.U., a special class of membership, "Overseas Associate", has been established, and overseas subscribers will automatically become W.I.A. members in this category.

The foregoing policy brings the W.I.A. into line with the practice adopted by A.R.R.L., R.S.G.B. and similar Societies.

VICTORIAN DIVISION, W.I.A.

160 METRE FIELD DAY

3rd August, 1969

Portable and mobile stations will, in addition to QSOs between themselves, welcome QSOs with home stations. Certificates awarded for longest distances contacts. Interstate stations are invited to participate and are eligible for certificates. Logs are to be sent to the Victorian Division, W.I.A., P.O. Box 36, East Melbourne, Vic., 3002.

ANNUAL DINNER

The Annual Dinner of the Victorian Division, W.I.A., will be held at the Sciences Club, Clunies Ross House, 191 Royal Parade, Parkville, on 24th September, 1969. Early application is advisable as accommodation is limited. Tickets, $5 per person including drinks. Application, with remittance, should be made to the Secretary, Vic. Div., W.I.A., P.O. Box 36, East Melbourne, Vic., 3002.

—...—

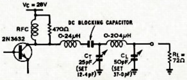
A SEMICONDUCTOR V.H.F. POWER AMPLIFIER

(Continued from Page 20)

Finally combining C1 and C2

$$C_T = C1 + C2 = 5.3 + 7.1 = 12.4 \text{ pF.}$$

Thus the completed tank circuit becomes



Similarly for two 2N3632s in parallel, operating 20 watts on 144 Mc., the following values may be calculated:

C_P (for pair) = 44 pF. R_P = 19.6 ohms.

X_s = 9.5 ohms and R_s = 12.1 ohms.

X_{L1} = 182 ohms and L1 = 0.2 µH. for Q of 15.

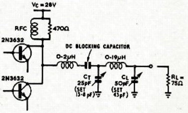
X_c = 172.5 ohms.

X_{C1} = 174 ohms and C1 = 6.35 pF.; R_{L1} = 2.51K ohms.

For a Q = 20 in the pi section:

C2 = 7.5 pF.; C3 = 43 pF.; and L2 = 0.19 µH.

Thus the completed Tank Network becomes



DX

Sub-Editor: DON GRANTLEY
P.O. Box 222, Penrith, N.S.W., 2750
(All times in GMT)

June saw a slight falling off in conditions on the higher frequencies, and, despite the presence of an expedition or two, the entire month was nothing to get excited about. As is the case in these falling-off periods, occasionally a band produces something out of the box, and this time it was on the ten metre band one afternoon at 0600z when ZS5FF, 9J2, 5R8 and some JAs were heard in Melbourne. If, however, the higher bands were not so good, this was made up by increased activity and better conditions on the lower spectrum. One excursion down to 40 at about 1900z yielded some 20 Europeans battling it out on the c.w. mode, whilst Mac Hilliard assures me that the s.s.b. Europeans have been plentiful a couple of hours later. No reports have been received on 80 or top-band activity.

We are indebted to George ZL2AFZ for the sunspot information ,to the effect that the July and August forecasts are 91 and 90, with the February confirmation being 121 as against a forecast of 98. All in all, it has been a reasonably good month, and with Gus still flitting around, the next few weeks will be worth watching.

Gus has varied his itinerary somewhat, and it would seem that the best thing to do is watch and wait, the word gets around pretty quickly when he is on. Bruce ZL3ABJ/C on Chatham is shortly due to go QRT.

DX nets are all the fashion these days, and there can be no doubt that they assist in the hooking of a wanted DX station, particularly in the case of a s.w.l. It is not for me to pass any comment, only to compile information, so here are a couple to go on with. The British Commonwealth net meet daily on 21354 at 0600z, and 14285 at 1430z. The Independent country net is on 14336 at 1600z. The N.Z. Chapter 67 meet on 2nd and 4th Tuesdays each month at 0830z on 3775. There is a Saturday and Sunday DX net on 14170 at 1200z with YV4UA in control.

The new prefix UZ3 is being issued to stations in the Moscow area, the other prefixes having been exhausted. Two known to be in use are UZ3TA and UZ3TB.

SK5AS is a club station in Sweden, the prefix system being used in that country being SK for club stations, SL for military stations, and SM for private calls.

Brunei is not an easy country to locate, and the following may assist. VS5TJ operates week days on 14320 s.s.b. at 1200z, then QSY to 14240/250 until QRT at 1330z. Also active is VP5SH who has been logged on 21270.

QSLs for CR6BX, CA, DA, DB, DX, FY, HL and IK can go to CR6GO at C.P. 10408, Luando, Angola, Portuguese West Africa.

There is still spasmodic activity from Mongolia to assist with the elusive Zone 23—JT1AG, JT1AK, JT1KAA and JT2AB are the regulars and are all on c.w., and in some cases the tx tone is a little on the rough side.

The bedlam which passes under the title of citizen band in the U.S. is occasionally logged here, and on one occasion I heard a tape made in the States, of the goings on in the 27 Mc. band. Much more interesting is the operating in the Novice segments, particularly on 40 metres. Though not DX in the strict meaning of the expression, many of these young lads are really fine operators and will provide the basis for much of the future U.S. Amateur activity. I had a look over their segment of 40 metres a few days ago when WH6GOZ and WN6EBY were having a very fine QSO. The bedlam of the aforementioned citizens band doesn't reign in the Novice segment, and for any Y.R.S. or young S.W.L. who is studying code, have a look for these lads in their band which is between the American phone band and the VK phone segment on 40 metres.

ITEMS OF INTEREST

The Camel Drivers net meets on 14325 s.s.b. from 1800z, and all QSLs for YA stations and net members can go to YA5RG, Wolfgang Renner, Box 279, Kabul, Afghanistan.

9X5AA advises that his QSL manager is W1YRC, not the one shown in some other publications.

FO8BW, active June 5 to Aug. 10, skeds W6JR 14260 s.s.b. at 0400z, after sked is QRZ for DX. All QSLs to home QTH W6JFM, and these will be processed after Sept. 1.

XW8 operation is often spasmodic. However XW8AX QSL W6KTE, XW8BP QSL DL9SX, XW8CR QSL W2CTN, and XW8CS QSL VE6AO are regularly in operation at the time of writing.

Frank DL7FT is now QSL manager for the following, for which a s.a.s.e. should be sent: EA6AR, EA6AS, EA6BG, EA6BH, F9UC/FC, HB0LL, OY2A, KL7BEK, KR6JT, KZ5EK, TU-2AY, TU2AZ, W4UAF/KH6, 3A2CN, 3A2EE, 3A0CU and 3V8BZ.

K9RHN and party will try and make 10,000 QSOs from PJ8MM on Sint Maarten over a period of 48 hours during the October "CQ" Contest with 10-160 metre operation. For his earlier operation from PJ8MM in early April, send QSLs to K9HRN, C/o. Collins Mail Stn., 407-022 Dallas Texas 75207. PJ8NN QSLs via K9GCE.

The proposed trip by WB6KBK and party to Roncador Cay and Bajo Neuvo has been cancelled for political reasons.

The Navassa Is. operation by K4IA/KC4 from June 22 went off on schedule with many QSOs on all bands. In a recent survey by Geoff Watts News-sheet, Navassa Is. was named by 79 of the world's top DX men as the most wanted country. Second was Clipperton Is., third Albania and fourth was Heard Is.

HC8RS operates s.s.b. on Saturdays to 0500z when power supply is shut off. Frequency is 14175, however his QSL manager SM5EAC claims that mails from Galapagos are very erratic and logs are often lost or delayed.

7Z3AB has changed QSL managers, the new one is W5NOP, his frequencies are 14212 and 21290. 9Q5WS is on 21040 c.w. from 2200-2230z daily, he is Syd., ex-TL8SW, and will be there until June 1970. QSLs via W1BPM.

WA4PUC/HS was only station thus far to have a permit to work U.S. stations, and he went QRT on April 2.

Further information on LI2B, the reed-boat "RA" in the Sth. Atlantic. They will work stations on 14234 u.s.b. after handling traffic on 14217. Amateurs are asked not to interrupt any transmission on this frequency, and are reminded that the station is operative only between 1000 and 1130z. He apparently works to a list prepared by LA5KG.

FW8RH went QRT on June 8 and is now FK8AH. FW8RC who went QRT some time ago is now home in France and signing F0GL. SV0WN, normally operates from Crete, but over the Easter period, together with SV0WMM and SV0WOO, were at Rhodes.

QSL MANAGERS

CR3KD—W2CTN	SV0SV—VE3GCO
CR5SP—W2GHK	SV0WCC—WA0HPU
CR6GA—WA3HUP	TA1MGK—WA6TFZ
CR6KT—W3HNK	TA1IB—W4GHV
CR6LF—W3HNK	TA1MG—K1UHY
EP2FD—WA5ERS	TF2WLM—K4SAK
EL8J—LA6OJ	TG9RN—DL3RK
F9UC/FC—DL9PF	TG8GL—VE3DCY
FG7XT—K5AWR	TU2AY—DL7FT
GI5AHS—WA2DHF	TU2AZ—DL7FT
GM5AHS—WA2DHF	ZS3LU—W2CTN
HB0LL—DL7FT	4X4VB—WA4WTG
HS3AL—W3KT	5A1TL—WB6WAA
MP4MBJ—G3POA	5A1TN—DL8OA
MP4TAF—DL6AA	5W1AS—WB6KBK
OD5LX—K4TSJ	5R8AO—GI3PLL
PA9HS—G3MZK	5Z4KO—WA1GIA
PJ5VL—PJ7VL	5Z4LQ—K2RAR
PX1FD—ON5FD	8P6CC—W4OPM
PY2PA—W2GHK	8QAYL—4S7YL
PY2PE—W2GHK	9E3USA—VE3IG
PY0EP—PY1MB	9F3USA—VE3IG
SK5BB—SM5DXV	9K2BV—W5GM
SK9WL—SM7CRW	9Y4RP—WA5MYR
SV0WMM—K6JAJ	9V4VT—W3DJZ

A2CAU—Box 200, Francistown, Botswana, Africa.
CT2AK—C.P. 143, Ponta Delgada, S. Maguel, Azores Is.
EA8GL—Box 860, Tenerife, Canary Is.
FY7YR—B.P. 93, Laurent-du-Marconi, French Guiana.
HK1BQR—Apto 785, Barrahquilla, Colombia.
HR4RB—Casilla 4, Amapala, Honduras Rep.
HK0TU—Via KH3RQ, Apto Aereo 4468, Bogota, Colombia.
IT1ITA—A.R.I., Box 20, Messina, Italy.
KC6CS—Milton Bennett, C/o. Peace Corps, Truk, Caroline Is. 96942, Pacific Ocean.
KS6CX—Via K4ADU, 5330 Buena Vista Rd., Colunbua, Ga. 31907.
OX5BA—R.C.A., Box 484, A.P.O. New York, 09023.
PJ2CK—C/o. 82 Acton Ave., Downsview, Ontrio, Canada.
PZ1BX—Box 2003, Paramaribo, Surinan.
VP2KC—Box 86, St. Kitts.
VP2AB—Box 229, Antigua, B.W.I.
3V8AC—Box 323, Tunis, Tunisia.
4S7YL—102/11 Templar Rd., Mt. Lavinia, Ceylon.
5W1AD—Box 63, Apia, Western Samoa, Pacific Ocean.
6W8DY—B.P. 10021, Dakar-Liberte, Senegal Republic, West Africa.
6W8XX—Box 3013, Dakar, Senegal.
7P8AB—Box 389, Maseru, Lesotho.
7Q7WW—P.O. Box 453, Blantyre, Malawi Africa.
7X0AP—Box 414, Alger, Algeria.
7X0BF—B.P. 2, Alger, Algeria.
9J2BR—Box 122, Lusaka, Rhodesia.
9Q5LC—B.P. 377, Mbujimayi, Kasai, Dem. Republic of Congo.

That winds it up for this month. My thanks to Geoff Watts, George ZL2AFZ, Long Is. DX Assn., Maurie Cox, Mac Hilliard, Maurie Batt, Eric Trebilcock, Newark News Radio Club, "Monitor," Bernard Hughes and Steve Rue-diger. I would appreciate any up-to-date information from any of the VK chaps. 73, Don WIA-L2022.

10th ALL ASIAN DX CONTEST, '69

PRECIS RULES

1. Period: 1000z hours, 30th August to 1600z hours, 31st August.
2. Bands: 1.8 through 28 Mc.
3. Modes: C.w. only.
4. Calls: Asians will call "CQ Test". All others call "CQ AA".
5. Entry: (a) Single-band operator; (b) multi-band single operator.
6. Cyphers: Five figures made up of RST plus age. For YLs, RST plus 00 (zero zero).
7. Scoring: One QSO point per Asian contact. Multiplier of one for each Asian country worked. Single-band score is total contact points x total countries worked. Multi-band score is total contact points on all bands x sum total of countries worked on all bands.
8. Logs: To J.A.R.L. Contest Committee, P.O. Box 377, Tokyo Central, Japan, to arrive not later than 30th Nov., 1969.

W.I.A. D.X.C.C.

Listed below are the highest twelve members in each section. Position in the list is determined by the first number shown. The first number represents the participant's total countries less any credits given for deleted countries. The second number shown represents the total D.X.C.C. credits given, including deleted countries. Where totals are the same, listings will be alphabetical by call sign.

Credits for new members and those whose totals have been amended are also shown.

PHONE

VK5MS	317/340	VK5AB	298/314
VK3AHO	312/326	VK4FJ	285/304
VK6RU	312/337	VK4KS	284/299
VK4HR	309/327	VK4TY	276/279
VK2JZ	306/323	VK2APK	275/280
VK6MK	304/323	VK3TL	271/277

New Member:
Cert. No. 98 VK4CZ 118/118

Amendments:

VK3ZE	227/230	VK2AHH	145/155
VK3AMK	170/170	VK4RF	143/143
VK5BB	170/173	VK2AGH	111/122

C.W.

VK2QL	301/323	VK3YL	270/287
VK3AHQ	301/315	VK3ARX	269/278
VK4FJ	290/314	VK2APK	267/275
VK3CX	289/312	VK6RU	266/289
VK2AGH	282/296	VK3NC	264/277
VK4HR	281/304	VK3XB	264/277

Amendments:

VK2AHH	130/138	VK4RF	126/138

OPEN

VK4HR	313/337	VK4TY	302/316
VK6RU	313/338	VK4FJ	298/322
VK2AGH	312/332	VK3ARX	292/301
VK2VN	306/323	VK2APK	292/302
VK6MK	305/324	VK3TL	287/293
VK2EO	302/325	VK3XB	286/274

New Member:
Cert. No. 118 VK3OG 103/103

Amendments:

VK4KS	285/304	VK2AHH	174/188
VK4RF	188/200	VK3AMK	170/170

Correspondence

Any opinion expressed under this heading is the individual opinion of the writer and does not necessarily coincide with that of the Publishers.

ROYAL SIGNALS AMATEUR RADIO SOCIETY

Editor "A.R.," Dear Sir,

As General Secretary of the R.S.A.R.S. and Editor of "Mercury", the journal of the Society, I wonder if you could assist the Society by publishing (at your convenience) details of the Royal Signals Amateur Radio Society. We are particularly interested in letting interested and eligible people in Australia know that membership is open as follows:

Associated Membership: "Any serving or retired member of a Commonwealth Signal Corps".

Affiliated Membership: "Any Amateur Radio Club of a Commonwealth Signal Corps".

Fees are ten shillings per annum for Annual Membership, and £5 for Life Membership, with affiliated fees the same for Club Stations.

"Mercury", the Society's journal, is published four times a year and sent free to all members. Other Society facilities include a members-only QSL Bureau, an Awards Scheme and various members' supplies, including QSL cards (plain and overprinted), Notepaper, Lapel Badges, Ties, etc.

At present we have members in the U.K., Germany, Holland, Malta, Gibraltar, Cyprus, Trucial Oman, Singapore, Malaya, Hong Kong, U.S.A., Canada, Brazil, etc.

Thanking you on behalf of the Society,

—WO1 (F. of S.) J. Cooper, G3DPS, General Secretary, R.S.A.R.S.

[Readers interested in becoming a member of this Signals Society may write to the Secretary at 15 Valley Road, Blandford Camp, Blandford Forum, Dorset, U.K., for an application form to become a member.—Ed.]

U.S.A. REGISTRATION PLATE

804 Woodland Way,
Richardson, Texas, 75080.

Editor "A.R.," Dear Sir,

I thought perhaps you would be interested in the enclosed photograph (shown above) of the back of my car.

—J. S. (Dick) Sisson, W5ONL/VK8AF.

S.W.L's LOGS

Editor "A.R.," Dear Sir,

After reading Mr. Cullinan's letter in May '69 "A.R.," I thought that I should second his idea of including S.w.l's logs in their zones scores in all contests. This would increase the S.w.l. participation and also add to the totals of the smaller zones. I am sure that in the smaller, and not so small, zones there are unlicensed members who could simply turn on their radio for a few hours and send in their logs, however small they may be.

—Andrew Dixon, WIA-L7051.

1969 JOHN MOYLE MEMORIAL N.F.D.

Editor "A.R.," Dear Sir,

June "A.R." to hand yesterday, and would like to say how pleased I was in getting top score in the receiving for all States, namely 1015 points.

It is noted, however, that I am getting more credit than I should as it is put in the **six-hour** list, not the **twenty-four**, as it should be. This score took about 16 hours to compile and would be impossible in six hours.

I was surprised at the small number of people interested in all sections, also the numbers that are not listed as putting in returns.

—"Tom" C. H. Hannaford.

IMPROVING OUR AMATEUR IMAGE

Editor "A.R.," Dear Sir,

The attention of your readers is drawn to the Presidential Editorial on the first page of May 1969 N.S.W. Divisional "Bulletin", in which the VK2 President, Mr. Gordon Clarke, warned that greater use must be made of Amateur bands if we are to justify retention of our allocations in the face of strong pressures from commercial interests which could make better use of our frequencies. He points out that the licensing authorities are continually monitoring our channels to assess the degree of gainful occupancy and, we must admit, the low degree of usage and, in many cases, the unmeaningful chatter that contributes nothing to our image offers little cause for optimism regarding the future of the Amateur Service. Already we have lost quite significant segments of various bands; non-Amateur services have moved into our allocations; certain formerly exclusive Amateur sectors are available to us only on a shared basis.

The only valid arguments that we can present for the continuance of an Amateur Service are (1) that we provide a pool of semi-trained operators in the event of war; (2) that some of our members have performed creditably and in the public interest during civil emergencies; (3) that in the early days of Radio a small proportion of licensed Amateurs made major contributions to the communications art, probably because of their professional training and experience rather than by participating in Amateur Radio. The field of electronics development is now the prerogative of the "professionals" with vast resources available to them. The Amateur has been phased out of this sector and, in most cases, is engaged in talking to himself about himself in somewhat confused and meaningless circles, making little real contribution to the non-Amateur world. Of the increasing numbers of personnel engaged in the Electronics and Communications services and industries, only a very few are interested in Amateur Radio. In fact, a large proportion of these regard the licensed Amateurs as the "lunatic fringe" of the Electronics area. Judging by a great deal of nonsense one hears on the Amateur bands, even intelligent Amateurs might be persuaded accordingly.

All these points demonstrate that the Amateur Service is NOT essential to the national welfare and one day the authorities are going to wake up to this fact and hand over our channels to non-Amateur occupants. This happened during the War and can happen again. To those of us who happen to regard Amateur Radio as a "good thing" only a gloomy picture is presented. One can conceive of some future time when Amateur Radio does not appear anywhere on the frequency spectrum. There are countries where Amateur Radio just does not exist and no catastrophes have resulted. It is quite easy to visualise a "Brave New Australia" where even the most diligent tuning will reveal no trace of Amateur verbosity. One can imagine beautiful Swans and Galaxies and similar exotic black boxes being cannibalised for the Stony Creek High School Radio Club! Sacrilege! Heresy! Treason! Is this fellow Black some sort of a nut (don't answer that) or a stirrer or merely clairvoyant? Have I shocked someone? Good and fine! Am I the only individual to think along these lines? No, indeed! Others with whom I have discussed these matters go along with these sentiments and regretfully admit that the Amateurs as a whole must take a long, cold and calculating look at themselves and their activities in the light of present situations and cease looking over their shoulders at the notable achievements of the earlier generations of Amateur operators. Those days are finished and new pressures exist of which we must be fully aware.

I support Mr. Clarke fully in his campaign for greater band occupancy. To achieve this, we must have more Amateurs than we have at present. On a population basis, and using U.S.A. as a reference point, we should have about 13,000 VK Amateur operators. Instead, we have fewer than 6,000. The rate of increase gives us no basis for optimism. The efforts of the W.I.A. Correspondence Course, the evening courses conducted by several State Divisions, the instruction provided by all-too-few district Radio Clubs, the work of the Y.R.C.S. and all the other educational agencies of the Institute produce only a slow increase in Amateur lists. Against the gains we must offset the quite substantial losses recorded monthly in "A.R.," the net gain being relatively small. It is obvious, therefore, that existing Institute agencies are just not producing sufficient numbers of new licensees to ensure adequate band usage and to demonstrate to the authorities that replacement of Amateur stations by commercial stations would be unjustified.

Having demonstrated these unpalatable facts, I must offer some constructive suggestions. In the face of expressed opposition from certain gentlemen in the W.I.A., and in the face of undoubted apathy from a large segment of the Amateur movement, I submit that the introduction of a Novice licensing system would go a long way towards achieving a dramatic increase in Institute membership and in populating the wide-open spaces in the Amateur frequency allocations. There are some very strong arguments in favour of such a scheme and only prejudice and woolly thinking on the other side of the debate. First, the American Amateur listing has doubled since the introduction of Novice licensing in 1951. Second, the leading nations in the field of Electronics—U.S.A., the Soviet Union, Japan—have had well-established Novice licensing systems operating for a long time and it is about time that Australia adopted similar methods to avoid continuance of its retarded situation. Third, the very conservative British G.P.O. has actually OFFERED to the R.S.G.B. a Beginner-type licence in order to encourage hobbyists to pursue Amateur Radio. Fourth, other nations of less importance in Electronics have been operating low-level licence systems with no undue ill-effects; such nations include Korea, Israel, India, the Faroes Islands, Finland, the Dominican Republic and Czechoslovakia. Fifth, Novice licensing is a well-developed facet of Amateur Radio elsewhere and there is no valid reason why it should not be introduced into this country.

One recalls wryly the hideous screams which arose from certain elements in the Amateur Radio field when the Limited A.O.C.P. was introduced. Contrary to the opinions of the "conservatives", the A.O.L.C.P. gave the Amateur movement here a real "shot in the arm" and the Institute benefited greatly from the influx of "No Code" members. I suggest that the introduction of a Novice system would provide a boost to Australian Amateur Radio, probably of greater significance than the introduction of the Limited ticket. Various specious and invalid arguments have been offered in other columns against the suggestion that Australia needs Novices, but the fact remains that the opponents have very little room to manoeuvre in the light of overseas developments at this level.

I suggest, however, that we might avoid the use of the term "Novice" as an undesirable Americanism and substitute some locally acceptable designation. My concept of a suitable low-level licensing system to meet our local conditions implies that such licensees are engaged in some form of formal training with the A.O.C.P. as the ultimate objective and that the "Novice" licence is not an end in itself. Accordingly, a suitable term to meet Australian situations might be something like Conditional, Provisional, Student, Training, Preliminary, Restricted or whatever. Contrary to vile insinuations made elsewhere, I do NOT, repeat NOT, advocate such a licence for members of the Y.R.S. alone, but suggest that mature candidates might well be included. Perhaps there might be room for two types of low-level licensing, one for bona-fide students and one for others who pursue their studies privately. That, however, is a matter of detail and the principal task is to persuade the Institute members first and ultimately the licensing authorities that low-level licensing is essential to meet present and future circumstances.

I summit, also, that one of our primary objectives should be to gain the support of the State and Federal Education authorities by demonstrating the valuable support which a low-level licensing system could offer to the current campaign by the Federal Government to foster Science Education. The introduction of "Novice" licences would involve the Government in negligible expense, whereas the Science Education programme costs the taxpayer vast sums.

In conclusion, I submit that the Institute in particular and the Amateur Service in general has nothing to lose and a great deal to gain by the introduction of a lower-level form of transmitting licence, which, I suggest, could involve adequate safeguards to protect the interests of the more highly qualified Amateurs by specifying crystal control, low power, limited operating hours, restricted frequency allotments, and such other limitations as may be introduced to meet the situation.

—R. C. Black, VK2YA.

(Correspondence continued on next page)

NOVICE LICENSING

Editor "A.R.," Dear Sir,

Enclosed you will find a copy of a letter which has been sent to the P.M.G. Radio Branch regarding Novice Licensing.

We have sent you the copy so as to put our view to the members of the W.I.A. and obtain their opinions on the subject, especially from those not in favour of this type of licence.

As stated in our letter, the question of Novice type licences has come about in what we would term **the lack of facilities available with-in Ham Radio for young students.**

We will inform you of any results.

—S. Greening and S. Voron (WIA-L2230)

[The following is the letter referred to above. Ed.]

C/o. The Radio Club,
Randwick Boys' High School,
Cr. Rainbow and Avoca Sts.,
Randwick, N.S.W., 2031.

Dear Sir,

We represent the members of the Randwick Boys' High School Radio Club. We are concerned with the lack of facilities and opportunities for young people, especially students, to increase their knowledge of radio, especially aimed at obtaining an Amateur Operator's Licence.

We would like to illustrate the circumstances by which radio enthusiasts lacking the facilities to increase their knowledge and interest in the hobby commenced the illegal use of radio for this purpose. This was brought about by the points listed below.

Say a person 15 years of age develops an interest in radio, if he knows very little about radio what facilities are open to him? Let us compare three countries. Firstly, in the U.S.A. he would either (a) obtain an Amateur Novice Licence or (b) operate a low power on Citizens Band (Walkie-Talkie). In New Zealand, there is no Novice Licence system, however Citizens Band fills the demand. What do we have in Australia? **No Citizens Band, No Novice system!** So what happens to this 15-year-old Australian boy and the many others like him? Does this mean his interest must be swept aside. Yes until some time when a system is introduced his interest will have to be swept aside. The problems facing a young student are numerous, the main ones being: Pressure of studies. He would not have the time necessary to achieve the standard necessary for an Amateur licence, as he is continually pressed by his studies and examinations. Also in his years of secondary and tertiary education he cannot afford to devote extra time to advanced study of radio.

In our earlier years we thought the problem of no importance when we left school, but for the fact that we now know what the problem is as we are High School students with the school certificate examinations approaching.

As a conclusion we have found that a Novice Licence would maintain and develop a students interest in radio during his studies.

During our meetings the question of Novice licensing was brought to our attention and after discussing it we found that a Novice Licence should facilitate points similar to the following:

1. The licence will only be issued once for a two-year period (two years will only apply to persons doing secondary and tertiary education, and one year for other people.) This was decided after consulting various technicians and Amateurs who agreed that two years is the maximum time necessary to achieve the standard necessary to attain a full Amateur licence.
2. The P.M.G. should print a booklet for sale to the general public containing the basic rules of radio theory and regulations necessary for receiving a Novice licence. This booklet should contain the foundations for further studies towards a full Amateur licence.
3. Morse code should have a speed of around 5 words per minute. This may seem slow but we must remember that this section of the Novice licence only applies to students who have just entered the radio field.
4. Modulation to be used. Modulation will consist only of a.m. and c.w. signals and power input should have a maximum satisfactory to the P.M.G. for this type of licence.
5. Frequencies. Sectors of the 160, 80, 11 and possibly 10 metre bands should be allocated to Novice licensees, to increase use of these bands not often used by the full Amateur himself.

We would greatly appreciate your opinion on this matter as we have given it much thought during the spare time we manage to get between our studies and examinations. Copies of this letter are being forwarded to Electronics Australia, Amateur Radio and the Wireless Institute of Australia.

Yours sincerely,

Samson Veron and Seth Greening,
President and Vice-President,
Randwick Boys' High School
Radio Club,

P.S.—During our discussions with local Amateurs two ideas were suggested:

1. Equipment to be used by Novice licensees should meet strict P.M.G. requirements, such equipment could be commercially produced by an Australian company, e.g. A.W.A., or Pye.
2. It was suggested that Amateur exams. should put more emphasis on measuring equipment to minimise and detect interference rather than the construction of transmitters for certain bands.

NEW FREQUENCY CONTROL ORGANISATION

The recent announcement of the formation of Hy-Q Electronics Pty. Ltd., a fully Australian-owned, advanced technological manufacturing company, will further strengthen the Australian telecommunications and electronics industry.

With laboratories and production facilities located in Frankston, Vic., Hy-Q Electronics will specialise in the manufacture of quartz crystals, quartz crystal devices and other related products.

The new company is a fully independent organisation, free of internal requirements and influence, and therefore will be able to fulfil the special needs of the Australian telecommunications industry.

Managing Director of Hy-Q Electronics is Mr. R. C. Richards, S.M.I.E.E.E., S.M.I.R.E.E. (Aust.).

Technical Director is Mr. D. H. Rankin, M.I.E. (Aust.), A.M.I.R.E.E. (Aust.).

Production Director is Mr. R. W. Taphouse and Marketing Director is Mr. T. A. Dineen, all very well known in the Australian frequency control and telecommunication field.

SIDEBAND ELECTRONICS AND YAESU MUSEN EQUIPMENT

Sideband Electronics, of Springwood, New South Wales, now have available a full range of Yaesu Musen equipment, all of which is tested and checked before despatch to buyers. The equipment is covered by the manufacturer's warranty which reads:

"We warrant this equipment against defects in material or workmanship, except for tubes, transistors and diodes, for a period of one year from date of original purchase. This warranty is valid only if the enclosed card is properly filled in and mailed to the factory within ten days of date of purchase. Do not ship to the factory without prior authorisation. This warranty is limited to repairing or replacing only the defective parts, and is not valid if the equipment has been tampered with, misused or damaged."

Sideband Electronics carry a range of spare parts to cover any likely needs of Yaesu Musen equipment users, and can also undertake service work if so requested.

VHF

Sub-Editor: CYRIL MAUDE, VK3ZCK
2 Clarendon St., Avondale Heights, Vic., 3034

This month I would like to thank the two correspondents from the Hobart area, and would appreciate more news from them and from members of other Divisions and V.h.f. Groups.

Next month we hope to have a report from Birchip where Ray VK3ATN, Les VK3ZBJ and Ken VK3AKK are attempting to receive signals from the Apollo 11 space craft during its return trip to the moon.

73 Cyril, VK3ZCK.

VK3 V.H.F. GROUP ANNUAL CONVENTION

This annual event of the VK3 V.h.f. Group will be held over the week-end of 11th and 12th October, 1969, in Gippsland. For further information write to the V.h.f. Convention, W.I.A. Victorian Division, P.O. Box 36, East Melbourne, Vic., 3002.

VICTORIA

The local v.h.f. activity, at least on the air, is rather low at present but a few new stations boasting the new limited call prefix VK3Y — — are naturally quite enthusiastic and are braving the cold shacks.

The number of bands on which we can go mobile and set a precedent was reduced even more in VK3 when Les VK3ZBJ "went mobile" on 1296 Mc. recently. Les has produced a "rig" which is entirely solid state for this band and also on 144 and 432 Mc. at a flick of a switch. This fine piece of equipment is ideal for portable/mobile operation. In addition, VK3s have used 432 Mc. and 576 Mc. as well as the popular 6 and 2 metres.

Some of the 432 Mc. rigs being built in VK3 should really provide steam on this band. Eric VK3ZSB is using a parallel pair of varactors driven by his 2 metre transmitter and proposes to use a 4CX250B complete with cavity. Bob VK3AOT is also underway with his rig which uses a mixer amplifier unit to drive a QQE03/20 and a pair of 4X250Bs as a linear amplifier. One 432 bird-perch which is becoming popular in VK3 is a 32-element extended phased array (5/8 wavelength driven element), ex W6AJF. This antenna is being used by a few, and they have found that it gives excellent results. 73, Peter VK3ZYO.

SOUTH AUSTRALIA

About 150 Amateurs from VK3 and VK5 attended the South-East Radio Group's annual convention at Mt. Gambier over the Queen's Birthday week-end. Everyone present had a very good time even though the temperature dropped below freezing point at one stage.

The winners of the competitions were—Scrambles: VK3AOT, VK3ZSB, VK5QZ. YL/XYL Scramble: Betty (VK3ZCK). Fox Hunts: VK5ZAI, VK3AXV, VK3ZHU. Hidden Tx Hunt: VK3ZGS. Mobile worked furthest from Mt. Gambier: VK3AIJ. Amateur travelling furthest: VK3FE. Best built mobile: VK5LP. 73 Colin VK5ZKR.

TASMANIA (Hobart Area)

The DX activity from here over the past few months has been almost nil. In fact it has been the worst for years, even openings to the mainland were rare and even 6 metres was not what could be called good. The only DX that could be recorded were the many contacts had with Winston VK7WH on Mt. Nelson.

The main net frequencies in use here are 53.032 and 144.1 Mc. a.m., and 146 Mc. channel B f.m.

It is proposed to instal a repeater on channel 3 to prevent interference from the Launceston one on channel 4. Incorporated in the unit will be a HI keyer which will operate every 20 or 30 seconds while the unit is on to remind operators that they are operating through the repeater. 73, Ron VK7ZRO and Brian VK7RR.

CHANGE OF ADDRESS

W.I.A. members are requested to promptly notify any change of address to their Divisional Secretary —not direct to "Amateur Radio."

Overseas Magazine Review

"BREAK-IN"

May 1969—

An All Transistor Two Metre Transceiver, Part 2, ZL4KU. This small unit runs about one watt to the final transistor and appears to be a unit which would find a place in the shack of the average v.h.f-er.

Safe Transformerless Mains Connections, by ZL2BEV. The writer uses a pair of low current relays to ensure that the power supply is correctly connected and the chassis never becomes live.

Modernising the Eddystone 750, ZL4IO. Mr. Shuttleworth is a prolific writer of receiver articles and in this offering he describes modifications to the 750 to fit it for s.s.b.

Chatham Island DX-pedition. ZL1DS tells the story of how he and ZL2AFZ became ZL1DS/C and ZL2AFZ/C during January, 1969.

"The Amateur Radio Service—Producer of Experts", ZL2AZ. Who else but an Amateur would design, engineer, purchase, construct, test, operate, maintain, etc., a communications system alone?

Around the World by Light Aircraft. ZL1BCY tells the story of how ZL1AKI proposes to blaze a trail around the world in a Victa Airtourer now made in Hamilton by Hamilton Aero Engineering Co.

"CQ"

April 1969—

Ham and Roses, Amateur Radio aids the Rose Parade. W6NAA describes how a group of Amateurs used v.h.f. radio to provide control of the Pasadena, California, Rose Parade. Perhaps it would be possible for W.I.C.E.N. groups in the various States to co-operate with State and Federal authorities in a similar way with such parades as Moomba in Victoria and Anzac Day and other such parades in other States.

A Transistorised Transceiver I.F. Strip for Mobile S.S.B. Use, VE7BRK. Transistorised unit operating at 5.25 Mc. using FT243 crystals in two cascaded four-crystal filters.

Instrument Landing Service. W1RIL describes how this device, which adds to the operating safety of the world's airlines, operates to ensure safe landing of aircraft in minimum visibility conditions.

A Simple Regulated 12V. Power Supply, K1BQT. A simple bench type supply using a minimum of components to supply 12v. at 600 mA.

Vertical Antennas, Part XI, W3JM. This instalment of the series describes the effects of earth on the efficiency of radiation and the vertical patterns to be expected from a vertical antenna.

Automatic Repeater Requirements. W7DQS discusses the requirements to be met by repeaters under the F.C.C. regulations.

Breadboard Dummy Load, Jim Ashe. A small, low power load for use in various projects from audio to v.h.f.

The Swan 500C Transceiver. W2AEF reviews this latest offering from Swan.

The Corkscrew, W2EEY/1. An antenna, adapted from a commercial design, having both vertical and horizontal polarisation simultaneously. Stated to be useful on any band but particularly the v.h.f. and h.f. DX bands.

"QST"

April 1969—

An Examination of the Gamma Match, by W3PG. A working analysis of the gamma match problem that gives useful practical results. New light on the question of when it will and when it will not give a perfect match to the co-axial transmission line.

A Compact Multi-Purpose Test Instrument, W0JF. Small enough to fit neatly into the palm of one's hand and using a 200 microamp. movement, it performs a number of functions often required by Amateurs.

The Evolution of an Amplifier, W2OL. An amplifier to run the U.S. full legal limit. It is a little large for Australia and the unusual tube is not likely to be available here.

An Electronic Paddle. W7BZ describes a simple gadget that can be used to operate a conventional electronic key by "touch" without any movement of the paddle. The resistance of the body is used to complete a circuit through a transistor d.c. amplifier to operate a pair of low voltage relays.

Some Notes on Solid State Product Detectors. W1CER describes a number of the latest solid state circuits and discusses their advantages and disadvantages.

The Delta-Loop Beam on 144 Mc., W1ICP. Lew goes up in frequency and describes a three-element design of this new type antenna for v.h.f.

Amplified A.G.C. for the Heath Mohawk Receiver, K4HEB/W4ZOJ.

Converting a Popular Six Metre Rig to V.F.O. Operation, K1QDR.

Application of Broadband Balun Transformers, W2IMU. Some very useful information, with applications far beyond the centre of a dipole.

A Simple Filter for the 1215 Mc. band, W0RUG. One for the u.h.f-ers.

A Hidden Mobile Antenna. W4TZB describes how to isolate and load up the framework of a "soft top" on a car. Come on you ingenious Holden owners, let us see you apply this technique to a Monaro!!!

Recent Equipment. Drake MN-2000 Matching Network.

Plus all of the usual features which Wayne Green of "73" says fills most of his competitors' magazines. "73" maintains they have more technical information in their issues than "those other 200-page magazines". "QST" for April has 172 pages and "CQ" 116.

"QST"

May 1969—

The D.C. 80-10 Receiver, W1CER. Doug De Maw describes a direct conversion c.w./s.s.b. receiver for 80 with plug-in converters for the other h.f. bands. It is easy to build, uses semiconductors throughout and provides Amateur-band only reception from 3.5 to 29.5 Mc. Stability and sensitivity are excellent. Operates into headphones and only requires 40 mA. at 12v.

Legalise Your Phone Patch, W4PME. Now that special legislation has been passed to make certain types of devices attachable to telephones, the "Phone Patch" as used by many DX Amateurs is taking on a look of respectability. The voice coupler—a simple device consisting of a capacitor, varistor, isolating transformer and telephone jack—is supplied by the telephone company.

A 500 Watt F.M. and C.W. Transmitter for 220 Mc. W1QWJ. Four tubes and a handful of semiconductors are used in conjunction with a final tuned cavity to produce an output of about 300 watts on 220 Mc.

The Mainline TT/L-2 F.S.K. Demodulator. W8SDZ. Stated to be an advanced design offering high-performance f.m. (limiter) and a.m. (limiterless) reception of radioteleprinter signals.

All Driven Three Element Mini-Beam. VE4AS describes a beam which is claimed to give performance very similar to that of a full size beam but is lighter in weight and less expensive to build as well as being capable of driving from an AR-22 rotator.

Long Delayed Echoes—Radio's Flying Saucer Effect. W6QYT, W5LFM and WA6NIL. The authors state that on rare occasions the echoes of radio transmissions persist for periods much longer than the time of propagation around the earth. First reported in Holland during the 20s, a number of scientists are keen to obtain more information and are enlisting the aid of Radio Amateurs as observers.

Some Common Problems and Their Answers, W1ICP. A continuation of the Beginner and Novice series Lew has been doing.

A 160 Metre Converter for Amateur Band Only Receivers, W4LQC/W8BKK. If your receiver or transceiver is one of the post-war breed that only covered Amateur bands from 3.5 to 30 Mc., then this article will show you how to put it on "Top Band". Yes, the A.R.R.L. seems to have adopted the British expression for this band too.

Mobile Whips and Corona, K0WQN. Increased operating power levels on 160 metres and the availability of kilowatt level mobile equipment for the other bands bring up the old problem of corona around the mobile whip. Some practical examples and solutions are discussed. (The reviewer feels that if Australian Amateurs use kilowatts mobile they may need to remain mobile!)

Galaxy R-530 Receiver. W1CER reviews this relatively new piece of general coverage equipment. His review succeeds that of "CQ" and so you are referred to one or other of the journals if more information is needed.

"RADIO COMMUNICATION"

April 1969—

Direction Finding and D.F. Receivers, G3JLE. Tubes or transistors, you may take your choice and then you will find something here to interest you if you are keen to make up something for that next hidden transmitter hunt.

Remote Control for V.h.f. Applications, by G5AFL. This article presents experimental concepts being considered by the author in connection with taking advantage of a remote and lofty aerial site for vastly improved v.h.f. performance, while maintaining control of the remote equipment from the comfort of the home station.

Technical Topics. G3VA discourses at some length on recent developments in the way of Homodyne/Synchrodyne/Direct Conversion Receivers/Transceivers for the various Amateur bands. He also describes a new communications receiver called the GT100 by Messrs. GT Electronics. Multiple conversion with most of its selectivity at 455 Kc., this receiver covers 3-30 Mc. and could probably be sold in Australia for about $2,000.

"73"

April 1969—

Dual Channel Oscilloscope Pre-Amplifier, W3ZZY. An inexpensive method of upgrading your present oscilloscope. The second channel is very handy even on a three-inch instrument. Built to give dual trace facilities for a Tektronix 360 d.c. 10 Mc. oscilloscope. Very good if you have a 360!

Simplest R.F. Pre-Amp. W1EZT describes a transistor unit which uses two 9v. batteries, two capacitors, two resistors and providing the transistor will amplify at the operating frequency, he says it adds gain. One for Aussies.

Education and Ecstacy, George Leonard. Associate Editor of "Look" magazine in a short article (all "73" articles are short) describes his first shortwave receiver and the thrill of hearing those first signals from distant stations on a product of his own hands and brain.

Push to Talk (The two-er way). VE3ETJ describes modifications to Heath's HW-30.

Variable D.C. Load. W2AJW describes a unit consisting of two 211s (VT4Cs) with a built-in variable power supply for bias so that the current drawn from a power supply can be adjusted in microscopic increments from 0 to maximum and beyond. Will probably handle up to about 2kV. For lower voltages, other tubes can be used and with some lamps and a few resistors a very useful device can be constructed. Not new. The Army Apprentice School had one in 1954 using 6L6s to handle 350 volts at 150 mA.

Single Side S.W.R. Bridge, WA5SWD. An s.w.r. bridge which has been made from a piece of single sided P.C. board suitably etched. Stated to operate up to a kW. and 144 Mc.

100 Kc. Marker Generator, W7CJB. Using a 2N409 and 2N384 or similar types, it is stated to provide markers throughout the Amateur bands.

One Technique to avoid that routine QSO.— W6EUV suggests ways and means of making contacts more interesting.

Minimum Cost Semiconductor Silicon Survey, Conrad C. Zaranski. How to get the best value for your money. A long "73" article, about eight pages.

Heath SB-610 Monitor Scope Modifications, by K6SDE.

V.H.F. F.M. Station Control, WA7EVX/0.

A Simple Portable Rig for Six, WB6BIH. Two transistors an IC and some battery and you have a six metre rig—almost.

Using FETs in Burst Generators, K3VKG. Pulses of r.f. are used for testing many items of equipment and they are becoming especially useful with semiconductor devices. This article describes some simple equipment for tests.

Two Metre Converter for the Swan 250 or anything else. K3VLQ describes a useful solid state device to put the receiver of your h.f. transceiver on two.

V.S.W.R. an Outmoded Parameter, VE2AXQ. This author agrees with VK2JR that s.w.r. meters sometimes give misleading information or that many of us do not know how to interpret the readings we do get. I've no doubt we can learn from both of them.

Drake V.H.F. Converters. W1EMV reviews a series of interesting commercial items which I have not yet seen advertised in Australia. They can be purchased individually or fitted into an attractive console.

About "Load"-ing. Which loads what or what does it mean? By "73" staff.

Zero Cycle Audio Filter for C.W., LX5SM/W4. Come on you c.w. addicts.

Kayla W1EMV has now departed "73" to get married to K4MWS and live in Florida. Wayne Green says he will miss her. He also says that it is possible to earn $50,000 p.a. on "Amateur" DX-peditions. Ah Wehl!!

CLUB STATION VK2BXK LOOTED

The active Kyeemagh Sea Scouts Radio Club was equipped with a licensed Amateur transmitting and receiving station, VK2BXK. It also provided training for the various Y.R.C. certificates and such aids as to permit students to proceed at a pace suited to the individual ability.

This station was built into a special steel cabinet in such a manner to allow ease of operation, provide neat storage facilities, serve as a model installation, and provide instructional demonstration as required. On the inside of the twin doors to this cabinet were mounted framed items such as W.I.A. registration certificate, photostat copy of the station licence, resistance color code chart, electric shock resuscitation chart.

Vandals have struck and the complete station looted. The Club has lost a Heathkit DX400 20-40-80 metre transmitter, variable frequency oscillator, Morse code oscillator, two Morse keys, a small auxiliary power supply, a National H.R.O. Type 1155 communications receiver and power supply, a Millen aerial coupling impedance matching unit, co-axial fittings and cabling, desk type microphone (xtal), aerial send/receive electric relay and a complete G5RV antenna with insulators, and "ladder" type impedance matching twin feeder which was down for overhaul and stored in the cabinet. Entry was gained by using a heavy instrument such as a crowbar to tear open the heavy duty cabinet housing the equipment. The various framed items torn from the doors were found scattered around the floor.

The financial loss to this small but active Club is severe, and they make an appeal for assistance (in the form of equipment or cash donations) to enable them to resume classes at an early date from another location.

—Noel Ericsson, VK2MF.

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THE AWARD HUNTERS' CLUB

INTERNATIONAL (A.H.C.)

REVISED RULES, EFFECTIVE FROM 1st JULY, 1969

The Award Hunters' Club (A.H.C.) International, incorporated as a judicial person under the Finnish law as "The Award Hunters' Club R.Y.", is divided into six Continental Sections. The Continental Sections are independent but all of them follow the general principles in the membership rules upon agreements co-ordinated by the A.H.C. International Headquarters. The Award Hunters' Club has been established since the end of 1957.

The Headquarters has the following main tasks:

(1) To co-ordinate the activities of the Continental A.H.C. Sections.
(2) To keep a register of world awards and certificates (published as "A.H.C. Bulletin").
(3) To maintain the "XL" Club as a goodwill recognition to highly skilled Amateur Radio operators all over the world.

REQUIREMENTS FOR MEMBERSHIP

1. The basic membership requires a minimum of twenty-five (25) different certificates and must comprise the following:—
   (a) At least 10 "official" certificates (i.e. those certificates sponsored by the I.A.R.U. Member Societies—I.A.R.U. Region 1 recommendations 1966).
   (b) Not more than 10 certificates may be from one's own continent.
   (c) At least 4 continents must be represented in the list of certificates submitted.
   (d) Certificates issued on contacts on "national" or "international" basis will only count (i.e. no local certificates).
   (e) Regardless of class or endorsement, the same certificate may be counted only once.

2. Endorsement stickers will be available for 50-100-150-200 and 250 certificates. At least one-third of the certificates submitted for endorsements must be "official". (Note: Local certificates may be used for endorsement purposes.)

3. Application: Send your Continental A.H.C. Secretary (A. Shawsmith, VK4SS, 35 Whynot St., West End, Brisbane, Qld.) a list of your certificates, giving the abbreviations of the award names in alphabetical order, full names of the awards, number and/or date of issuance of awards, possible endorsements. Certify the correctness of the list with your own signature. No other certifications are required, but any falsification in the application will lead to the disqualification of the applicant.

4. The fees: Registration fee, giving you a life-long membership, is based on $1 U.S. Equal amount of any currency or IRCs may be used upon agreement with your Continental A.H.C. Secretary.

A.H.C. SERVICES
(care of A.H.C. Headquarters)

Summary list of "official" awards. 2 IRCs.

"A.H.C. Bulletin", duplicated 16-sheet (loose-leaf) publication giving information on award rules. Subscription fee $3.00 U.S. or the equivalent per 12 issues (2 IRCs per issue).

The "XL" Club. Rules available for return postage. "XL" Club was introduced on 1/1/66.

—From VK4SS.

SILENT KEY

It is with deep regret that we record the passing of—

VK3GM—George R. McCulloch

HAMADS

Minimum $1 for forty words.
Extra words, 3 cents each.

HAMADS WILL NOT BE PUBLISHED UNLESS ACCOMPANIED BY REMITTANCE.

Advertisements under this heading will be accepted only from Amateurs and S.w.l's. The Publishers reserve the right to reject any advertising which, in their opinion, is of a commercial nature. Copy must be received at **P.O. 36, East Melbourne, Vic., 3002, by 5th of the month and remittance must accompany** the advertisement.

ABLE Morse Code Instructor is available for private tuition. Can guarantee to get you through the code in the most efficient way. For further details, ring 277-2005 (Melbourne) and ask for Morse Code Instructor.

ANY Buyers for Galaxy 12 volt Mobile Power Supply, $70. Also set of VK4DA Mobile Helical Whips for 80, 40, 20 metres, $35. All guaranteed in good order. Contact VK3AO, 383 Warrigal Road, Burwood, Vic. Phone 288-2326.

FOR SALE: Bendix RA-1B Communications Receiver with a.c. supply and speaker, $50. Pye Mk. 3 two-channel 12v. Carphone on 6 metres, $30. Home-brew 6 and 2 metre a.m. Tx's complete with a.c. supply and mike, $30. Home-brew CRO with three inch CRT as is, $12. Or offers. VK3ZNC, P.O. Box 175, Maffra, Vic., 3860.

FOR SALE: Collins S-Line, consisting of 32S1, 75S3 and 30L1 linear. $1,500 o.n.o. K. Moore, VK6KM, 191 Ninth Ave., Inglewood, W.A., 6052.

FOR SALE: Compact, custom built, 160 metre, 20 watt, a.m./c.w. transceiver. Tunes 1500 to 2000 Kc., 12 tubes, xtal locked b.f.o., product detector, squelch, S meter/plate meter, high level plate and screen mod., p.t.t. or mox. Complete with a.c. p.s.u./spkr., net frequencies xtals, $85 o.n.o. 48 Orchard St., Glen Waverley, Vic., or phone 232-9492 (Melb.).

FOR SALE: Creed Model 75 Page Printer with reperferator without keyboard, $50. Creed Model 6S/5 Tape Distributor, $50. M. Faulkner, P.O. Box 602, Katanning, W.A., 6317.

FOR SALE: Heathkit Marauder S.S.B. HX10 Tx, 80-10, 160w. p.e.p., vox, p.t.t., $325. Heathkit S.S.B. HR20, 80-10, sep. supply, $100. HCR62 Rx, 550-10, $100. Type 3 Mk. 2, $40. ATR2C 80-40 Tx-Rx, a.c. power supply, $30. VK3AGE, G. Esam, 18 Crawley St., Warrnambool, Vic., 3280.

FOR SALE: Swan 350 as new, with all mods., 12v. mobile P/S, A.C. P/S, mike; CDR Ham M Rotator without control unit. $600 the lot, F.O.R. All had very little use. VK1IL, 27 Kavel St., Torrens, A.C.T. Phone 86-1095.

FOR SALE: Swan 350 Transceiver with 230 a.c. power supply, vox, cal., u.s.b./l.s.b., and s.w.r. bridge, $500. FLDX2000 Linear, only 1 month old, $250. 500 watt Acitron Mobile Power Supply, only 1 month old, $90. Webster Bandspanner Mobile Whip, $45. M. Faulkner, P.O. Box 602, Katanning, W.A., 6317.

RECEIVER Star 600, triple conversion, all bands, crystal calibrator, notch filter, pre-selector, condition as new, leaving 240 volt area. Price $225 or near offer. F. Willis, rear Athenaeum Hall, Doncaster, Vic., Phone 848-1386 (Melb.).

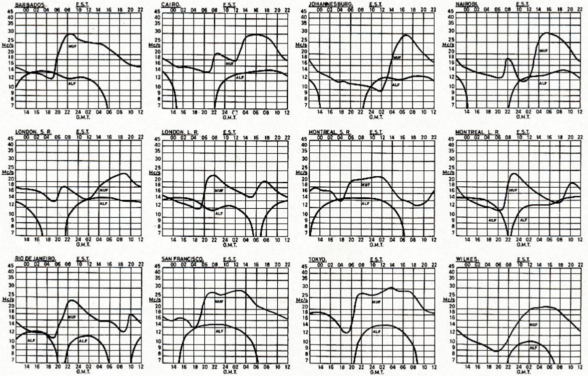
SELL: Heath DX35 compact bandswitched Transmitter, 80 through 10 metres, 75 watts c.w., 60 watts a.m. controlled carrier phone. 12BY7 xtal oscillator or buffer, 12BY7 driver, 6146 p.a., 12AX7 speech amp., 12AU7 modulator, internal solid state 240 volt power supply, with stable matching VF1 VFO, manuals, $70. Could be converted to s.s.b. Basil Dale, VK2AW, 19 Gorrell Cres., Mangerton, Wollongong, N.S.W., 2500.

SELL: New 2 metre American "Tunaverter", tunable 140-150 Mc. into 1500 Kc. I.f. Ideal for use with car radio. This is extremely sensitive, latest model and can also be used crystal locked. Sell at landed price of $35 as 2 metre receiver recently purchased. Roth Jones, 1 Albert Road, Melbourne, Vic., 3004. Phone 26-6911.

TRANSCEIVERS No. 19 Mark II., plus power supplies. Comprising of a 2-8 Mc. set and a 240 Mc. v.h.f. set. $10 each. Phone 89-4997 (Melb.).

PREDICTION CHARTS FOR AUGUST 1969

(Prediction Charts by courtesy of Ionospheric Prediction Service)



TECHNICAL ARTICLES

Readers are requested to submit articles for publication in "A.R.," in particular constructional articles, photographs of stations and gear, together with articles suitable for beginners, are required.